

**Nomination for Engineering Heritage Recognition  
of  
*SUPER CONSTELLATION* - VH-EAG  
Historical Aircraft Restoration Society**



**VH-EAG *Super Constellation***



**54-0157 Davis-Monthan Air Force Base 1988**

*Through the history of aviations only a few aircraft have excelled to become a legend,  
The Constellation was one such aircraft*

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Engineering Heritage - Sydney  
March 2016**

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#### Note:

- For the sake of simplicity, generally, the author has used the aircraft's USAF identification number 54-0157 for the time it was owned by the USAF and its current Australian Registration Number VH-EAG from the time it was placed in the hands of the Museum of Victoria and subsequently HARS to identify the aircraft throughout this document.
- Aircraft people still use the Imperial system units for altitude - feet, distance - nautical miles and speed - knots as for vessels.  
This is the reason why both Imperial and SI units are given throughout this document.

1. <b>Nomination of VH-EAG for Engineering Heritage Recognition</b>
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The Administrator  
Engineering Heritage Australia  
Engineers Australia  
Engineering House  
11 National Circuit  
**BARTON ACT 2600**

Nominated Item:                    **Lockheed *Super Constellation* C-121C [L1049F] <sup>(1)</sup> - VH-EAG**

Nominated For:                    **Recognition under EA Engineering Heritage Recognition Program**

Location:                            **HARS Museum facility at Illawarra Regional Airport - Albion Park**

Owner:                                **Historical Aircraft Restoration Society Inc. [HARS]**

The Owner, HARS has consented to VH-EAG being proposed for recognition as a moveable item of significant engineering heritage under Engineers Australia Engineering Heritage Recognition Program - [refer Appendix 1]

Access to Site:                    **off Princes Highway Albion Park**

Nominating Body:                **Engineers Australia, - Engineering Heritage Sydney [EHS]**

Recommended Level of Recognition      **Engineering Heritage International Marker**

Glenn Rigden

*Chair Engineering Heritage Committee Sydney*

Date

(1) The aircraft remains essentially in its L1049F/ C-121C military configuration but with the non-standard wing-tip tanks fitted it has the appearance of a L1049G model *Super Constellation*.

## 2. INFORMATION IN SUPPORT OF THE NOMINATION

## 2.1 Basic Data

**Current Name:** Lockheed Super Constellation [L1049F] VH-EAG Southern Preservation 'Connie'

**Former Names:** USAF C-121C [L1049F] Identification Number 54-0157 <sup>(2)</sup>  
N41154Q [first post-restoration flight only from Davis-Monthan Air Force Base to Tucson International Airport]

**Location:** Illawarra Regional Airport Albion Park NSW

**Address:** [off the Princes Highway] Corner of Boomerang and Airport Roads

**Local Government Area:** Shellharbour City Council

**Owner:** Historical Aircraft Restoration Society Inc.

**Current Use:** Static display, flying exhibit, air-show circuit participant, commemorative flights, corporate fund raising to support operation of HARS. The aircraft provides work experience and camaraderie for young and old HARS members interested in practicing or learning skills both old and new. This includes flight crew training and flying opportunities for pilots, flight engineers and load masters.

**Former Use:** High-speed, long-range military transport of freight, passengers and mail for military units and embassies, medical evacuation and a diversity of humanitarian missions, long-range strategic air-lifts, airborne command and control support of airborne electronic counter surveillance in the US and overseas theatres of war.

**Designer:** Lockheed engineers Hall Hibbard - Chief Engineer, Don Palmer Project - Engineer and C L [Kelly] Johnson<sup>4</sup>.  
The design was carried out at Lockheed's 'Skunk Works'

**Builder:** Lockheed Corporation [now Lockheed Martin]

<b>Year Started:</b>	<i>Constellation</i> series of aircraft - first flight	09 January 1943
	<i>Super Constellation</i> series of aircraft - first flight	14 July 1951
	54-0157 was delivered to USAF,	06 October 1955
	HARS began restoration VH-EAG	November 1991

<b>Year Completed:</b>	[Restored] First Flight	23 September 1994
	CAA Certification	23 January 1994
	CASA Certification	23 January 1996

2. This serial number means it was the 157th aircraft funded by the USAF in 1954
3. Through the conduct of flying operations and the performance of necessary maintenance work on the aircraft HARS members - flight crew personnel, a range of engineers and other personnel - many retired, the aircraft provides purposed work for these people to maintain their skills and the opportunity to train others.
4. VH-EAG has been used to train Lufthansa aircrew hoping to fly their L1649 aircraft that is currently under restoration in USA.
5. Kelly Johnson went on to design many other planes of note such as the P-80 Shooting Star, F-104 Starfighter, U-2 spy plane, SR-71 Blackbird strategic reconnaissance aircraft.

## 2.2 Physical Description of VH-EAG:

The Lockheed Constellation series of aircraft, of which VH-EAG is one, were considered by many to be an elegant and sophisticated long-range, four piston-engined, propeller-driven, aircraft. These aircraft were available in either a civilian or military configuration and in their many variants were a widely used and popular aircraft of the pre jet age era.

*Information on VH-EAG statistics is given in Appendix 5.*

The *Super Constellation* is instantly recognised from its dolphin-curved fuselage, its signature triple elliptical tail fins and optional tear-drop wing-tip fuel tanks<sup>6</sup>.

VH-EAG was built in a military multi purpose configuration as a high-speed, long-range transport aircraft. This variant included a cargo floor with large cargo doors fore and aft and standard freight interior trim. In its personnel ferrying role it could transport up to seventy five personnel with their equipment. In its freighter role it could carry up to fourteen tons of cargo. The multi-purpose configuration also allowed the aircraft to be readily converted to a medical evacuation role to accommodate up to forty-seven stretcher cases and included provision for carrying an iron lung.

It is powered by four Wright R-3350-93A state of the art [in their day] powerful fuel injected, twin row, 18 cylinder turbo-compound, air-cooled radial-engined power plants driving Hamilton standard hydromatic 43H-60 3-blade, constant speed, full feathering, reversible propellers.

In normal operation the aircraft had a typical long-range cruise speed of between 350 to 407km/hr [190 to 220 kt].

A maximum level-flight-speed of 480km/h [260 knots] and a maximum dive-speed of 546km/hr [295 kt]. A service ceiling of up to 8300m [27,000 ft] when operating pressurised. Un-pressurised operation is limited to 3000m [10,000ft].

The C-121 operating at its normal max takeoff weight of 62370kg [137500lb] in standard conditions can expect to achieve a range of around 3500km [1890nm].

The C-121 had a military maximum overload limit of 145,000lbs [65770 kg]. However, in this overload condition its performance would become very limiting.

Operations using 100/130 octane fuel with subsequent engine power de-rating resulted in a reduced maximum all-up take-off-weight of 54430kg [120,000 lbs].

While the aircraft remains essentially in its military C-121C [L-1049F] with HARS initiative to fit wing-tip tanks it has the appearance of a model L1049G *Super Constellation*.

## 2.3 Physical Condition:

A meticulous restoration and an ongoing commitment to a high standard of maintenance, carried out in accordance with HARS developed, CASA approved, type-specific Operations and Maintenance Control Manuals, Engineering Procedure Manuals, Inspection Check Sheets and other quality control documentation, signed off by the HARS volunteer Licenced Aircraft Maintenance Engineers gave CASA the confidence to issue the aircraft with a certificate of airworthiness endorsed in the "limited category" This coupled with extensive aircrew ground and flight training ensures that HARS operates the aircraft in a safe and professional manner.

## 2.4 Modifications and Compliance:

Listed here are just some of the main upgrade and compliance issues addressed by the restoration team prior to the flight to Australia:

- compact modern VHF navigation and communication equipment has been installed. [much of the original radio communications and navigational equipment has been installed inactive for visual authenticity].
- modern HF radio fitted along with a temporary back up HF for the delivery flight.
- an improved intercom system.
- GPS navigation equipment in the cockpit and at the Navigator's station.
- modern complying civilian ATC transponder.

- modern life rafts and other emergency equipment for the delivery flight much has been retained.  
[The life rafts can be again carried for Australian compliance where and as required.]
- upgraded aircraft internal and external emergency and normal signage and decals to satisfy Australian requirements.
- comfortable complying passenger seating and their seat tracks
- altimeters were modified to satisfy Australian barometric scale and display compliance.
- engine instruments limit markings were changed to reflect de-rated engine requirements.<sup>(6)</sup>
- cockpit decals were changed to reflect de-rated performance data.
- all of the many Australian Airworthiness Directives affecting the aircraft were complied with where possible and where not, exemptions were sought and granted.
- all applicable USAF and American FAA engineering directives were addressed and complied with.
- an approved observers seat was fitted in the cockpit for crew training purposes..
- Lockheed P2 Neptune nose wheel and tyre assemblies approved and fitted in lieu of unobtainable standard Constellation wheels
- addition of the tear-drop wing-tip fuel tanks [which were seen to be inseparable from the variant's charisma in airline service]<sup>(7)</sup>

## 2.5 Repair/ Refurbishment/ Overhaul:

- replacement of a number of engine cylinders due to their not meeting inspection requirements.
- replacement of several engine power recovery turbines due oil leakage or blade damage.
- replacement of all 144 engine spark plugs.
- overhaul of all 72 engine fuel injection nozzles
- overhaul of engine HRD fire extinguisher bottles including replacement discharge squibs.
- overhaul of brake and auxiliary boost accumulators
- overhaul of all eight main brake assemblies
- overhaul of four hydraulic pump control valves
- overhaul of all fuel selector and shutoff valves
- replacement of defective lower section of nose landing gear leg
- overhauled electric fuel booster pumps
- replacement of all essential flight instruments, most of which had been cannibalised.
- replacement of number two engine due to an impending internal failure.

## 2.6 Renewal/ Replacement of missing Items that were originally on VH-EAG:

- replacement of cabin outer window panels due to sun-related deterioration
- replacement of nose and main wheel tyres
- replacement of many cockpit and nav station instruments cannibalised over the years in storage
- replacement of nearly all of the cannibalised avionic equipment originally fitted to the aircraft making it serviceable where advisable or fitted for visual and historic authenticity only.

(6) engines which had originally been designed for discontinued high octane 115/145 [high lead content] avgas were de-rated to use 100/130 avgas - resulting in a loss of 400kW power/ engine

(7) The aircraft was not originally fitted with wing tip tanks. HARS found two during the restoration and fitted them to replicate the Qantas L1049G configuration. These tanks have not been connected to fuel system.

**2.7 Items originally Installed on VH-EAG but not Reinstalled or Made Operational Again**

- removed some of the air conditioning and pressurisation system<sup>(8)</sup>.
- removed cabin superchargers fitted to engines 1 and 4 as they were now redundant .
- removed de-icing boots from wings and tail surfaces. [under VH-EAG's restricted licence operation in icing conditions is not permitted.]
- removed engine vacuum pumps that drove the de-icer boots.
- removed original crew oxygen bottles [the aircraft now carries portable oxygen cylinders as required]
- removed military weather radar components because the system was considered non-restorable.

**2.8 Historical Notes:**

*Refer to Chapter 4 and Appendix 2 of this nomination document for dates and details.*

**2.9 Heritage Award Listings:**

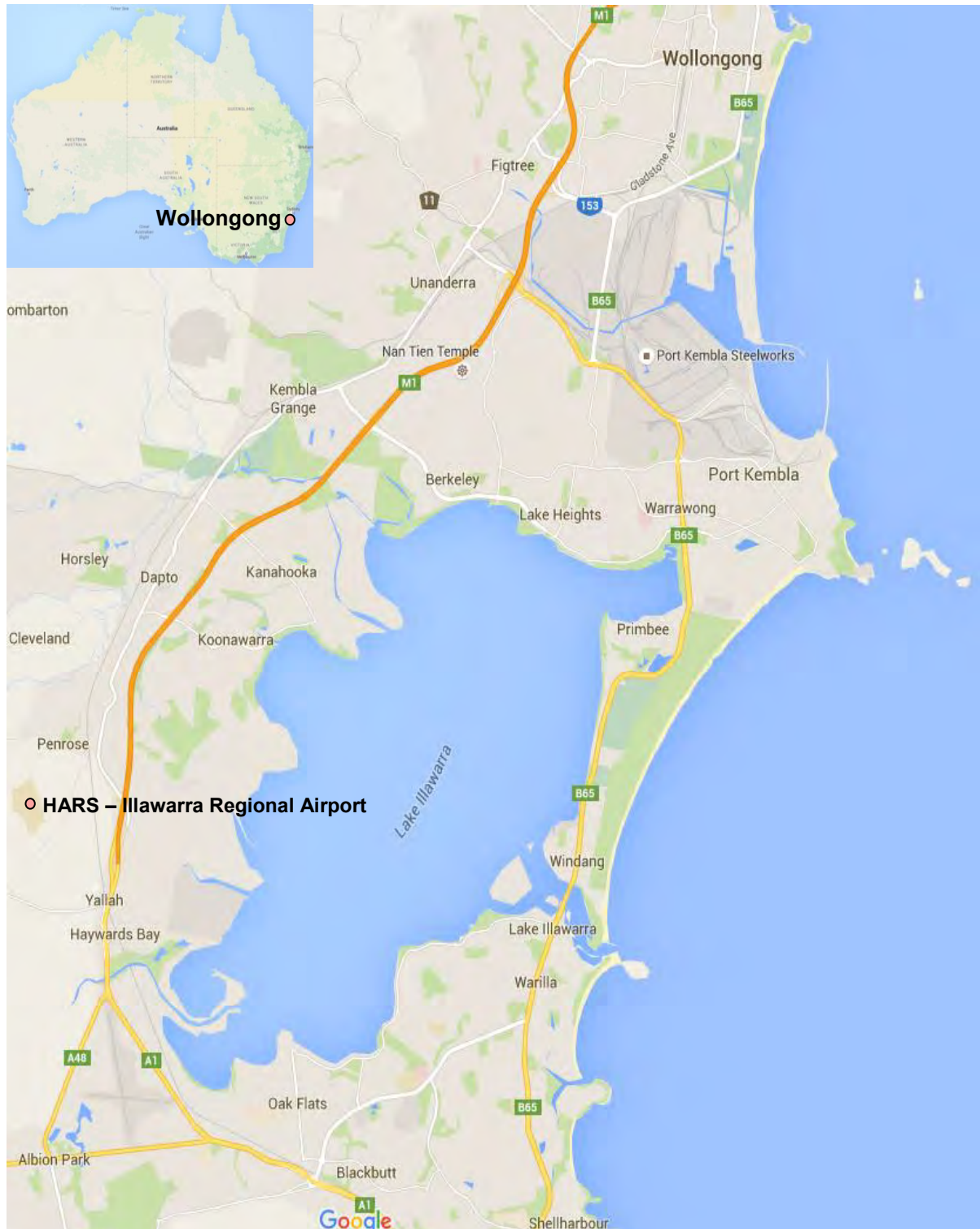
In 1997 the International Guild of Air Pilots and Air Navigators awarded the Grand Master's Australian Award to HARS in recognition of the outstanding restoration of the VH-EAG *Super Constellation*.

**2.10 Current Use**

The current use of VH-EAG is as an historic exhibit presented in a near-original condition that can be experienced and enjoyed by HARS members and the general public. It's availability for air-shows and commemorative flights is compatible with her historic value and presentation.

- (8). The aircraft was designed and operated as "pressurised". Structurally the restored aircraft was capable of being operated pressurised. However, restoration of the complex air conditioning and pressurisation systems would have been too costly and a time consuming task on top of the work required to ensure that the aircraft was serviceable.  
Un-pressurised, aircraft are generally limited to an altitude of 3000 m [10,000 ft].



**3. Location of HARS MUSEUM - *Super Constellation* VH-EAG**



## 4. History

### 4.1 Introduction.

Arguably the most graceful and beautiful airliner of its day - with its dolphin-curved fuselage, triple elliptical tails [and the later *Super Constellation* G and H variants optional tear-drop wing-tip fuel tanks], the first Lockheed *Super Constellation* L1049 model celebrates its 65th birthday in July 2016. [First flight 14 July 1951]

Conceived in the late 1930s to carry more people further and faster than ever before and economically enough to broaden the acceptance of flying as an alternative to other modes of available transport, the resulting design; the *Constellation* represented the ultimate in airline performance. In its civilian configuration during the 1950's it offered the ultimate in luxury air travel.

The introduction of jet aircraft in the late 1950s and 1960s led to the displacement of propeller-driven aircraft from frontline service. Those aircraft that were not scrapped were relegated to lesser roles.

*Constellations* were scrapped in their hundreds. As a result of this scrapping there are now fewer than sixty "survivors" left in the world. Of these, only two airworthy aircraft - HARS VH-EAG at Albion Park, Australia and the *Super Constellation* Flyers Association HB-RSC in Basel, Switzerland are left to tell the story of this iconic aircraft.

### 4.2 Historical Aircraft Restoration Society [HARS]

HARS is an organisation that is committed to preserve our collective aeronautical heritage. [Additional information on HARS is included in Appendix 10]

The HARS Museum is not just a building complex at the Illawarra Regional Airport. Inside the Museum is a large collection of aircraft - airworthy, under restoration, static display, aircraft engines, aircraft fuselage sections, aviation memorabilia, its information resources and its membership. It is the largest museum of its kind in Australia and compares favourably in size and diversity of its collection of aircraft with other similar significant aviation museums around the world.

HARS has a CASA approved workshop and consequently can carry out maintenance and repair of its aircraft.

Apart from Qantas and Virgin, HARS has the largest civil aviation licensed engineering workforce of any civil aviation organisation in Australia - albeit all volunteer

### 4.3 Background

The use of aircraft in WW I accelerated the development of aircraft, and post-war fliers of note sought to be the first to traverse continents and oceans by air. While this pursuit to conquer distances continued into the 1930s, civil aviation remained restricted to limited capacity airliners providing regional services overland over relatively short distances. Longer flying routes over oceans were usually the province of flying boats and airships. Towards the end of the 1930s aircraft manufacturers, to meet the request of airlines, focused on the development of four-engined landplane aircraft to challenge the fiefdom held by rail and sea for transport of passengers and time-dependent cargo.

From these appeals the Lockheed *Constellation* was born.

### 4.4 The *Constellation* [277 built]

The *Constellation* was designed by the Lockheed Aircraft Company in response to a request from TWA [Trans World Airlines] in the late 1930s. [In the 1930s manufacturers tended to align their business interests with individual airlines. Trans World Airlines and its major shareholder Howard Hughes shareholder were strong advocates of Lockheed. Hughes was prepared to help finance the development of the new aircraft]. The brief was to design a revolutionary four-engined aircraft capable of comfortably flying 44 passengers and 2700kg [6000lb] of freight at speeds of 400 to 480km/h [220 to 260kt] at an altitude of 6700m [22000ft] with a nominal 5600km [3000nm] range - across the United States; offering commercial aviation's first coast-to-coast non-stop service. Understandably the design process from concept to final design took a number of years to complete.

The resultant aircraft's performance was so good, the US military, readying for war, saw the *Constellation's* - re-designated C-69, potential for fast ferrying troops and supplies to the European war theatre. It was for this purpose the US Military commandeered all Lockheed production and directed only military versions of the *Constellation* be produced. The first official flight test for the four-engined *Constellation* took place in January 1943. The C-69 could accommodate 63 military personnel, a maximum speed of 540km/h [294kt] at 3100m [10000ft], cruise at 500km/h [272kt] at 6000m [20000ft], a service ceiling of 7300m [25300ft] and with a full load its range was nominally ~3350km [2085nm].

Originally the aircraft was powered by Pratt and Whitney R-2880 engines but Lockheed later chose the more powerful Wright Cyclone R-3350 C18/2, 1640kW [2200hp], twin row 18 cylinder air-cooled radial engine as the aircraft's power plant which necessitated the use of a large three-bladed propeller with a diameter of 4.62m [15ft 2in]. The wing design was based on the Lockheed P-38 Lightning and incorporated Fowler flaps. To avoid an excessively long nose undercarriage leg yet allow sufficient propeller-tip ground clearance, the aircraft's nose was curved downwards. To avoid propeller wash over the tailplane the aft fuselage was curved upwards. Consequently no two bulkheads were the same due to the continuous curvature throughout the length of the fuselage. To allow the aircraft to use existing hangars, it was designed with a triple tail fin configuration in lieu of a higher single tail fin.

It was the largest, fastest transport to serve in World War 2.

This aircraft would form the basis for future civil transports.

After the war the *Constellation* came into its own as a fast civil airliner. The first passenger *Constellation* aircraft did not come off the production line until the end of 1945. The aircraft variant L-767 was a world beater. It was very fast with a maximum speed of ~560km/h [300kt] and could carry ~65 to ~90 passengers. A pressurised cabin meant it could fly above much of the weather [~7,500m or ~25,000ft] making it a comfortable aircraft to fly in.

#### 4.5 Super Constellation [579 built 259 commercial, 320 military]

With ongoing improvements in technology and refinement by the aircraft manufacturers, both commercial and military operators asked manufacturers to offer new aircraft with increased speed, payload and range than that currently offered by the *Constellation* and its competitors. The *Super Constellation*, Lockheed's response to the Douglas DC-6 airliner, incorporated more than 550 improvements and modifications [compared to the L-749 model]. The fuselage was extended by 5.7m [18ft] to increase the length to 35.4m [116ft] by inserting two constant diameter fuselage 'plugs', one before and one after the wings, the fuel capacity was increased, larger cockpit windows were installed, heating and pressurisation were improved and the aircraft was now powered by improved 2014kW output R-3350 -956C18CA and later, the state-of-the-art 2,424kW output R-3350-872CC18DA] turbo-compound supercharged radial engines: the *Super Constellation* met all that had been asked for and more.

Using its preferred 115/145 high-octane avgas the performance figures were:

- cruise speed 425km/hr [230knots]
- maximum speed 600km/hr [325knots],
- service ceiling 8300m [27000ft]
- full-load 14 tonnes [31000lbs]
- maximum range ~3500km [1900nm].

The first production model flight of this aircraft was on 14 July 1951.

#### 4.6 Qantas

The *Constellation* and the later *Super Constellation* were very popular with many airlines after WW2, in particular, Qantas.

From the late 40s up to when Qantas moved into the jet age in 1959, the *Constellations* were Qantas' main long-range passenger aircraft. The first *Constellations* purchased by Qantas in 1947, the L749, enabled Qantas to begin flying long-range services to Europe - in particular the famous Kangaroo Route to London, and USA.

Introduced into Qantas service in 1954 the *Super Constellation* was in service with the airline up to 1963.

The last of the *Super Constellations* acquired by Qantas - L1049G, in 1957 were used to inaugurate its regular around-the-world service - a world first in January 1959.

*Refer Appendix 7 for details of the Qantas owned aircraft.*

#### **4.7 HARS Super Constellation VH-EAG**

VH-EAG '*Southern Preservation*' [allocated Lockheed model number L1049F], is the C-121C militarised version of Lockheed's famous range of *Constellation* aircraft which revolutionised air transport during the late 1940s and 1950s. Externally, with the addition of its wing-tip tanks VH-EAG is similar in appearance to Lockheed's 1049G variant of the *Super Constellation*.

#### **4.8 VH-EAG/ 54-1057 Military Service Life refer Ref 20**

VH-EAG was built at Burbank, California in a C-121C military configuration [Lockheed model L-1049F, company number 4176] for the United States Air Force [it was one of a batch of thirty-three personnel/cargo transports fitted with strengthened undercarriages ordered by the USAF in 1951].

As 54-0157 it was delivered to the USAF on 11 July 1955 and assigned to 41<sup>st</sup> Air Transport Squadron [Heavy], 1608<sup>th</sup> Air Transport Wing, Military Air Transport Service [MATs], Charleston AFB South Carolina.

October 1956 it was reassigned directly to the 1608<sup>th</sup> ATW[H] at Charleston AFB. During the course of its assignment 54-0157 was deployed to the Azores and Morocco.

25 July 1962 saw it redeployed to the 183<sup>rd</sup> AAS, Mississippi ANG Jackson, Mississippi. [This squadron was the first to operate C-121Cs in the Air National Guard. Here it had an aero-medical airlift role and also started flying general transport missions.

January 1964 saw it reassigned to the newly activated MSANG 172<sup>nd</sup> ATG[H] Jackson, Mississippi. On 1 January 1966 the 183 was redesignated as a military airlift squadron [MAS] as part of the activation of Military Airlift Command.

On 14 February 1967 with the conversion of the 183<sup>rd</sup> MAS C-121Cs, the USAF transferred 54-0157 to the West Virginia ANG 167<sup>th</sup> MAG Martinsburgh Municipal Airport.

On these placements it was employed in transporting military personnel, materials, mail, and the medical evacuation of patients within continental America and overseas to locations

March 1972 54-0157 was transferred to the Pennsylvania ANG 193<sup>rd</sup> Tactical Electronic Warfare Group [TEWS], Harrisburgh Pennsylvania where it supported EC-121S *Super Constellations* [converted C-121Cs] - flying radio/TV stations employed in psychological operations including deployment to South-east Asia during the Viet Nam war. In this role 54-0157 served in a transport role supporting group operations and other taskings assigned by Headquarters, Military Airlift Command. This included deployment to Spain between May and August 1976 in support of USAF 401<sup>st</sup> Tactical Fighter Wing

By late 1970s 193 TEWS had begun changing over to Lockheed C-130 Hercules aircraft and on 28 March 1977 54-0157 was removed from active service and was transferred to the Military Aircraft Storage and Disposition Centre [MASDC] at Davis-Monthan AFB Tucson Arizona, with a total of 18,452 flying hours credited.

The aging aircraft was turned over for storage at the adjacent 309<sup>th</sup> Aerospace Maintenance and Regeneration Group [AMARG] - the 'boneyard'.

It was assigned inventory number CK201 and put into deep storage [mothballed] which involved applying latex coverings to all intakes, exhausts, door and hatch perimeters as well as vulnerable surfaces such as windows, de-icing boots and the like. Engines and fuel tanks were oil inhibited.

#### 4.9 The Search for a *Super Constellation*

From when it was first established HARS sought out aircraft to grow its collection of civil and military aircraft. The stated objective of the Society is to acquire, restore and preserve aircraft of significance to Australia and where possible keep them in an airworthy state.

Members of HARS hoped one day that HARS would acquire a *Super Constellation* an aircraft that had been an important player in Australia's and international aviation history.

There were a number of unsuccessful attempts to obtain such an aircraft including one to secure the last Qantas *Super Constellation* which was auctioned in Kuwait in 1982.

Although initially supported by Qantas, a later attempt to obtain a *Super Constellation* to be chartered to fly in a Bicentennial Air Show lapsed because of logistic issues.

In 1990 when some HARS members were in Tucson Arizona collecting Neptune spares for the two HARS Lockheed Neptunes they noticed a mostly intact but derelict ex-US Airforce EC-121H *Super Constellation*. In a moment of madness the thought occurred that such an aircraft should be recovered and restored to preserve a vital memory capsule of Australia's aviation history. Some time later the Director of the US Air Force Museum in Dayton Ohio when in Sydney, alerted members of HARS that the museum might have a *Super Constellation* surplus to its requirements, and subsequently, negotiations commenced for its acquisition.

Considered obsolete and of no further use as a military aircraft, 54-0157 storage maintenance ceased in 1981. As a result, the aircraft was designated of scrap value only. Failure to properly close up the aircraft after a periodic inspection permitted access to legions of birds to nest and foul the interior over many years. The scrap metal merchants did not bid on the aircraft because the guano [over 500kg] could have made the smelted aluminium unsaleable.

In early 1990s it appeared C-121C 54-0157 was the only suitable Lockheed *Super Constellation* in the world whose ownership was unambiguous so this was the aircraft that HARS set its sights on.

Over time, the airframe, power plant, avionics components and cockpit instrumentation had been cannibalised.

In December 1991 HARS people flew to AMARG to inspect 54-0157. Surprisingly the airframe was found to have no significant corrosion and the four engines appeared to be able to be brought back to operation. But clearly the legacy of the pigeon occupation - live and dead birds, nests everywhere and what turned out to be over 500kg of dry health-affecting powdery guano would be a significant problem to remove. Despite all this, the decision was made to pursue acquisition of the aircraft with the intention of bringing 54-017 back into airworthy condition. A task that many thought nigh impossible.

In the Bicentennial year-1988 the Australian Federal Government made grants to establish two national museums - Australian National Maritime Museum to be located in Sydney and National Air and Space Museum of Australia [NASMA] which was placed under the control of the Museum of Victoria.

To cut a long story short, the National Museum of the United States Airforce - the owner of 54-0157, could not deal with a non-government body but was receptive to passing ownership to the Museum of Victoria. That deal was sweetened by the offer by HARS of a restored Bristol Beaufighter cockpit.[which allowed the USAF to authentically restore the Beaufighter held in its extensive collection of aircraft at its Dayton Ohio museum].

The Museum of Victoria negotiated terms for acquisition of 54-0157 from USAF Museum ownership while HARS drew up an accord with the Museum of Victoria which undertook that . HARS would restore the aircraft at its own expense and deliver it to Australia and for this, would be granted a 10-year lease to operate the aircraft as a flying exhibit

In March 1992, HARS started what was to become a major project when 54-0157 was placed in HARS care for restoration and delivery to Australia. Relying solely on volunteer labour the project was to take five years. The restoration work commenced in May 1992 when VH-EAG was towed from the MASDC to the Pima Air & Space Museum Tucson Arizona, next to the Davis-Montham Air Force Base

A major difficulty in the restoration process was funding volunteer travel and accommodation that was required to carry out the extensive and demanding restoration work in Tucson. The conditions the team worked under were often stressful as the restoration work had to be carried out mostly in the open - over dirt, in the extremely hot, [and in winter freezing] dry Arizona desert.. Refer photos in Appendix 3

The restoration of 54-0157 to airworthiness required an in-depth examination of all facets of the aircraft - its engineering, its operation, training and regulatory requirements.

Brief statistics on this project were:

- 47 team trips of an average of 6 to 8 persons were mounted, each averaging 14 days
- 16,000 man-hours were expended on the project [all volunteered]
- some \$800,000 in cash was raised and spent
- approximately \$1.2m was raised in sponsorship services

To formalise the situation regarding ownership, on 3 August 1994 the US Department of Transportation - US Air Force Museum transferred ownership of 54-0157 to the Australian National Air & Space Museum of Australia noting on the Aircraft Bill of Sale it was in the care of Historical Aircraft Restoration Society.

In September 1994 following CASA registration hence forth it would be known a VH-EAG and the aircraft as the *Super Constellation* VH-EAG took to the air after nearly eighteen years languishing on the ground.

After a lot of angst, eventually approval was given for a once only ferry flight to Tucson International Airport on 23 September 1994 where Lockheed had agreed to fully paint-strip and repaint VH-EAG to its new livery in its large dedicated spray booth located within their Tucson Aeromod Center.

The aircraft came out of the Lockheed facility in the 1950s Qantas livery complete with the Flying Kangaroo on the outer fins, the famous symbol of the airline since the first *Constellations* in 1947 - the only difference was that the word 'Connie' replaced 'Qantas' on the upper fuselage and wing tip tanks. Outstandingly beautiful again confirming it was one of the most pleasing-to-the-eye aircraft ever designed with its dolphin-curved fuselage, triple elliptical tails and iconic tear-drop wing-tip fuel tanks.

Wright R 3350 engines were designed to use high octane 115/145 highly leaded fuel. Production of this fuel stopped many years ago for environmental reasons. A lower octane 100/130 octane fuel was and is still is widely available as a permissible alternate fuel. However, the use of this fuel required a reduction in usable engine power output with many consequent aircraft performance limitations. This was documented in performance data certified by Wright, the USAF and other operators. Further supporting this information, HARS was able to purchase a more recent Supplementary Type Certificate [STC] owned by a defunct private operator of ex US military aircraft. The FAA issued STC assisted HARS in its safe and approved operation of the aircraft.

This first flight included some test flying – the take off, some handling trials including steep turns, instrumentation checks, engine performance, flight control and trim checks followed by landing performance. All went well. Another two test and training flights were undertaken on 25 September and three more later.

However, the planned flight to Australia was not yet to be as:

Another solid year of work - including an engine change, a move to full Australian registration and certification requirements and 38 hours of flight crew training was necessary before the venturous trans-Pacific flight to Australia.

- the CAA advised, in its opinion, the US authorisation to fly the aircraft to Australia under a US FAA "Ferry Permit" was invalid under International law. Therefore full Australian certification requirements would apply. This was a significant change.

Faced with the evidence that this bold extensive project was nearing completion, regulatory authorities increased their focus on their requirements. Although the FAA and CASA were keen to see success for the project, their own responsibilities did require them to increase their level of surveillance.

Fortunately, HARS had worked to the strict maintenance requirements applicable to the aircraft. Extensive historic maintenance records for the aircraft were available, further supported with detailed records of all the restoration work carried out by HARS.

Additionally, CASA required that HARS develop a Maintenance Control Manual, an aircraft specific HARS developed inspection documentation system and that HARS submit an updated Flight Operations Manual.

The USAF Flight Operations Manual that came in the extensive documentation package that accompanied the aircraft was updated to include the STC data mentioned above. The other requested documentation was developed, submitted and approved.

CASA required that an appointed Aircraft Surveyor of their choice carry out an extensive inspection of the aircraft and its documentation. HARS welcomed this highly experienced engineer and the detailed advice and report he developed during and following his work in with HARS in Tucson.

- one engine required replacement due to an impending internal failure The engine problem was solved by a fortunate paid exchange with one from the Pima Air and Space Museum.

In early September 1995 CASA issued a Special Certificate of Airworthiness - Aircraft Airworthiness Category - Special with conditions . [For a list of these conditions see Ref 1 pp123 - 128] that were required to be complied with for the trans-Pacific ferry flight to Australia. The issue of this certification permitted resumption of flying and crew training aboard VH-EAG. On 23 January 1996 the appointed CASA Special Delegate issued an Australian Special Category Certificate of Airworthiness [with conditions] which was subsequently endorsed by CASA

On 25 January the flight took off destined for Sydney Australia. The stages for the flight were Tucson to Oakland, Oakland to Honolulu, Honolulu to Pago Pago [American Samoa], Pago Pago to Nandi [Fiji] and Nandi to Sydney.

On 3 February 1996 the *Super Constellation* VH-EAG, triumphant, arrived in Sydney after an incident-free crossing of 39.5 hours flying time.

On arrival at Mascot VH-EAG was fittingly accorded VIP treatment with an extensive coverage by the media; a wonderful welcome by family, friends, fellow HARS members and the airport as a whole. As one admirer said - "mate she looks drop-dead gorgeous."

The successful flight of 12000km [6500nm] was the culmination of one of the most ambitious restorations of a large piston-engined aircraft ever undertaken. It has enabled a rare example of this revered aircraft to in a new life to fulfil a dream by HARS members and others to return a *Super Constellation* to Australian skies for the first time in thirty years.

On 21 February 1997 following agreement between the USAF and the Museum of Victoria and a supplementary agreement between HARS and the Museum of Victoria the ownership of VH-EAG passed from the Museum of Victoria to HARS.

CASA issued a Special Certificate of Airworthiness for VH-EAG on 23 June 1996

<i>Airworthiness Category</i>	Limited,
<i>Purpose</i>	Exhibiting an Historic Aircraft
<i>Expiry Date</i>	Indefinite

The CASA issued Special Certificate of Airworthiness reads:

This Certificate of Airworthiness is issued pursuant to the Convention on International Civil Aviation dated 7 December 1944 and Civil Regulations of Australia, in respect of the abovementioned aircraft which is considered to be airworthy when maintained and operated in accordance with the Civil Aviation Regulations and limitations specified in the Flight Manual approved or issued for the aircraft under the Civil Aviation Regulations

VH-EAG could not remain at Mascot long-term because of the premium space it was occupying. Some months after its arrival it was flown to Bankstown airport where it was held in the open. With the sale of the aerodrome in 2002 it was forced to move again. Many sites were investigated including Nowra.

Shellharbour City Council, the owner of the Illawarra Regional Airport, and local industry such as BHP [now BlueScope Steel] and Cleary Bros were keen to see HARS establish itself in the Illawarra. In 2002 HARS made a welcome decision to make its new home at the Illawarra Regional Airport at Albion Park.

VH-EAG is one of only two<sup>(12)</sup> flying *Constellations* in the world and the only one in the southern hemisphere.<sup>(12)</sup> The other aircraft is the Breitling supported *Constellation* "Star of Switzerland" based in Basel Switzerland<sup>(13)</sup>

Comment:

1. The Breitling *Super Constellation* does not fly year-round being laid up over the winter.

Significant in the life of VH-EAG is that it is a survivor only because of the perseverance, enthusiasm and skill expended by the dedicated members of HARS, and the many generous donors who contributed financially and in many other ways. HARS rescued the aircraft from its 'graveyard' in Tucson Arizona and the volunteers, when they were at Tucson, worked hard, long hours to restore and maintain the aircraft – always in accordance the highest standards of workmanship that is the norm for Qantas LAMEs and Australian aviation.

That in itself is a story worthy of recognition.

Comment:

1. The HARS LAMEs - some current, many retired Qantas engineers, worked to the same exacting standards demanded in the airline industry.
2. The livery was meticulously researched eg tracking down the precise colour - carnation red, of the fuselage trim.

#### 4.10 Fundraising and Assistance

At the time of embarking on their commitment to restore 54-0157 to a state of airworthiness it was realised that considerable costs would be involved and at that time HARS did not have that sort of money.

It was obvious to those HARS members driving the project a successful outcome would rest on obtaining initial seed funding to commence the restoration and that it would require continuous and expanding funding throughout the project.

HARS became a registered charity and donors were able to claim tax deductions. So it could be said that the wider taxpaying public also contributed to the restoration cost.

Corporate sponsors were approached via managing directors and CEOs as well as the general public. Anyone who it was thought could help was followed up with requests to donate money and/ or services.

As it turned out, the assistance given many companies and individuals was readily forthcoming and came with great enthusiasm and support for the project. Many American, as well as Australian, companies were willing to provide assistance in many areas at no cost or at reduced rates. Where sponsorship or donation failed scrounging came into play.

Of particular note:

**Qantas:** provided many plane tickets and transport of equipment, some work space at Mascot, engineering support, the use of training facilities and a suite of ex Boeing 767 passenger aircraft seats.

**Lockheed Corporation Tucson Aeromod Center:** provided some engineering assistance, stripped and repainted the aircraft and provided in hangar work space during the final phase of restoration.

- (12). A third *Constellation*, a L-1649 Starliner is currently in the USA being restored to airworthiness by Lufthansa for their museum and a fourth and fifth *Constellation*, also in the USA - ex-Presidential [Air Force 1] *Constellations* - L749 VC-121E Columbine II and EC121 Columbine III, are all some time off from becoming fully airworthy.

A sixth possibility is to be brought from the Philippines disassembled to the Qantas Founders Museum in Longreach Queensland and reassembled to be reassembled as a static exhibition.

- (13). Interestingly the HARS and Breitling aircraft were built next to each other in the Burbank factory. VH-EAG is c/n 4176 and the Breitling *Constellation* is c/n 4177.



***Pima Air and Space Museum:*** allowed use of their facilities including the restoration hanger for undercarriage retraction tests, tooling and equipment. They also made a replacement engine available.

The US authorities, such as the USAF Museum and Federal Aviation Authority, and CASA all proved to be of assistance, which was much appreciated.

## 5. ASSESSMENT OF SIGNIFICANCE

### 5.1 Historic Phase:

Lockheed *Super Constellation* VH-EAG is significant from an historic perspective because:

- It is the only remaining airworthy *Super Constellation* in the southern hemisphere and the only one that flies year-round.
- It is representative of the passenger and cargo carriers used by Qantas and other major airlines in the 1940s and 1960s.
- It demonstrates the end of an era in transport technology – the large, radial-engined, propeller-driven aircraft that were overtaken by the jet age.
- It was the largest and fastest cargo transport to serve in World War 2

### 5.2 Historic Individuals or Association:

Lockheed *Super Constellation* VH-EAG is significant from a historic perspective because:

- It is associated with the major aircraft builder Lockheed Corporation and Australia's principal air carrier Qantas with which *Super Constellations* were in service from 1954 to 1963..
- It is a memorial to the personnel who at one time flew and maintained this type of aircraft in war and in peacetime.
- It is inspiring evidence of the dedication of HARS volunteer members who persevered to restore VH-EAG to an airworthiness state and to save and preserve it, as well as the many other heritage aircraft that make up its collection .

### 5.3 Creative or Technical Achievement:

Lockheed *Super Constellation* VH-EAG is significant from a technical perspective because:

- It can rightly be said that the aircraft is close to original condition.
- As a remarkable survivor, it demonstrates the design, materials and technical development of large propeller-driven aircraft of the 1940s and 1950s.
- Research and practical work carried out for its restoration has rescued the technology of the large propeller-driven, piston-engined aircraft era from being lost and provides a practical example of how these aircraft were operated and maintained.
- Its engines represent the zenith in the design of turbo compound piston aircraft engines
- It demonstrates a quantum leap in aircraft restoration, whereby a large aircraft which was once the province of major airlines, could be restored by a private group such as HARS.

### 5.4 Research Potential:

Lockheed *Super Constellation* VH-EAG is significant from a social perspective because:

- The aircraft and the HARS facilities are readily accessible to interested researchers

It is evidence of:

- The design, materials and technology used to build such large four- engined, propeller- driven commercial and military aircraft.

- The revival and understanding of operation and maintenance skills associated with the late-era large, propeller-driven large aircraft- skills relating to - turbo compound radial piston engines, hydraulic systems, electrical systems, control systems, fuel systems, airframe and avionics that were necessary during the time these aircraft were in service.
- The skill sets required by the flight crew - pilots, flight engineers and navigators, to operate such an aircraft in the 1940s through to the 1970s.
- The conditions under which aircrew worked in these large propeller- driven radial piston engined aircraft.
- It is an exemplar of the restoration of a heritage item; of what can be achieved by volunteer organisations with appropriate vision, persistence, hard work, research and attention to financing.

**5.5 Social:**

Lockheed *Super Constellation* VH-EAG is significant from a social perspective because:

- It demonstrates to later generations the large propeller-driven aircraft from the end of that era
- It is of great significance to the dedicated group who sought its recovery, who restored it, have committed to its maintenance, have flown it and who have supported it financially.
- It demonstrates the airliners of a bygone era by participating in community events such as museum open days, air-show performances and commemorative flights.
- Along with the other aircraft owned by HARS [see the full a list in Appendix 10], it is a significant tourist attraction around Australia and has captured the imagination of the thousands of people who have gone on board to learn its history and its stories.
- It is associated with the development of industrial heritage preservation as a voluntary leisure pursuit among Australians and a growing awareness that heritage is economic, social and cultural capital.
- The training of volunteer artisans and the very accomplishment of the lengthy restoration project has resulted in the re-learning and extension of traditional skills.
- The sight of VH-EAG flying the skies above Wollongong and elsewhere has captured the public's imagination and has enhanced enthusiasm and interest in the conservation of aviation heritage.
- VH-EAG demonstrates the conditions under which flight crews, passengers and maintenance personnel operated.
- It represents the ultimate in airline performance and luxury during the 1950's.
- Maintenance and operation of the aircraft provides meaningful and life-enhancing experience to a number of member aircrew, engineers and other volunteers.
- . It is called on to participate in community events such as museum tarmac days, air-show performances and commemorative flights.

**5.6 Aesthetic**

Lockheed *Super Constellation* VH-EAG is significant from an aesthetic perspective because:

- The restored aircraft reveals the aesthetic, functional and historic value of this iconic aircraft that plied the skies for commercial and military purpose in the period 1940s into the 1960s.

- It represents an era of commercial passenger air transport that was remembered as adventurous, glamorous and romantic.

**5.7 Representativeness:**

Lockheed *Super Constellation* VH-EAG is of representative significance because:

- It is one of only two *Super Constellations* in an airworthy condition that regularly flies.
- We now have in Australia an icon of post-war commercial air transportation.

**5.8 Integrity and Intactness:**

Lockheed *Super Constellation* VH-EAG is of significance because:

- Essentially it is in its as-built original condition. As part of the restoration process, every part of the aircraft and every component were carefully inspected by the LAMEs and, if warranted, it was stripped down and repaired or fully overhauled or replaced with identical components sourced mainly from aircraft and engine spares dealers within the USA.
- The restoration of the once derelict aircraft, the addition of the wing-tip fuel tanks and the return to her [all but] 1950s Qantas livery enhances its visual attractiveness.

**5.9 Rarity:**

Lockheed *Super Constellation* VH-EAG has rarity value because:

- It is one of the only two airworthy, Lockheed *Super Constellations* remaining in the world, the only one in the southern hemisphere. [Ref 1] and the only one that flies on a year-round basis. [All other remaining Lockheed *Constellation* and *Super Constellation* aircraft are either unsalvageable wrecks or static exhibits. refer Appendix 8]
- It is a rare example of the immediate post-war aircraft that Qantas used to become an international passenger carrier of significance. It enabled Qantas to operate a truly international service, offering services from Australia to the US, to the UK and on to Australia and later offer the world's first round-the-world-service.

**5.10 Other Points of Significance:**

Other facts relative to the level of recognition for VH-EAG are:

- It has been recognised by government at all levels, by industry and by the Australian public through their donation of money, labour, and services.

**5.11 Statement of Significance:**

The *Super Constellation* VH-EAG is significant because :

- It is one of only two airworthy Lockheed *Constellations* in the world, the only one in the southern hemisphere and is the only one that flies year-round.
- It is associated with the major aircraft manufacturer - Lockheed Corporation and, indirectly, with Australia's national carrier Qantas.
- It demonstrates the ultimate technological development of piston-engined airliners that existed prior to the advent of jet airliners
- It represents the type of aircraft that brought in an era of mass air transport .
- It is inspiring evidence of the dedication of heritage volunteers who have preserved many significant aircraft.

- Research and engineering during its restoration has re-discovered, revived and recorded 1940s and 1950s build and maintenance skills that have been of value in subsequent restorations and conservation work.
- Its restoration has engendered pride in the wider Illawarra community and in members of HARS and has given impetus to other groups that restore and maintain aircraft.
- It demonstrates the increasing awareness in the community of aviation heritage and a commitment to undertake challenging heritage projects and to acquire vanishing skills, as a leisure pursuit.

**5.12 Comparisons:**

Aircraft of the same era and configuration - large 4-engined, propeller-driven aircraft that performed a comparable role to that of the *Constellations* were:

Boeing 377 Stratocruiser  
Douglas DC-6  
Douglas DC-7  
Douglas C-124 Globemaster  
Bristol Britannia  
Vickers Viscount

**5.13. Recommended Category of Award:** Engineering Heritage International Marker

## 6. Interpretation Plan

### 6.1 General Approach

A date for a recognition ceremony has not been finalised with HARS..  
The ceremony will be held at HARS Albion Park facility alongside VH-EAG - *Connie*.

In determining the information to be included on an interpretation panel it should be remembered when visitors inspecting VH-EAG there are always experienced and knowledgeable HARS volunteer guides on hand <sup>(14)</sup> who can tell them the story of the aircraft and answer any technical questions - this is considered to be far better than the limited information any interpretive panel can provide.

However, it is acknowledged that it is important that when visitors are on board the aeroplane they need to be aware that her engineering heritage has been recognised by organizations such as Engineers Australia and the International Guild of Air Pilots and Air Navigators.

*From conversations with the HARS President, it is unlikely that HARS would be amenable to having more than the standard EA - EHA mini-plaque installed on the aircraft but if they do agree to the installation of a recognition panel, this is the suggested presentation [which would have to be first signed off by HARS].*

### 6.2 General Attributes of the Interpretation Panel

1. Title Lockheed Super Constellation VH-EAG
2. Sub title *Connie*
3. Logos of Engineers Australia and HARS would be incorporated into the design.
4. 300mm diameter representation of the EHA marker plate would be included
5. Date and other details of the recognition ceremony would be included
6. Text to be 24 point Arial Bold or as suggested by a graphic artist.

### 6.3 The Interpretation Panel

1. Size to be nominally 350 mm high x 400-500mm wide
2. The panel to be manufactured - vinyl film on aluminium with mounting holes
3. The panel to be placed in *Connie* in a prominent position

### 6.4 Suggested Panel Wording 118 words

#### **Lockheed Super Constellation VH-EAG - 'Connie'**

**VH-EAG came into service on 6 October 1955 and after a long life as a transport with the US military was retired from duty on 28 March 1977.**

**Restored by volunteer members of the Historical Aircraft Restoration Society and through the generosity of Qantas and others, Connie demonstrates the design, materials and technology used to build the last generation of large piston-engined propeller-driven aircraft.**

**She is the last airworthy Super Constellation in the southern hemisphere.**

**Her restoration and ongoing maintenance are associated with the revival of the skills that were in her day required for her build and in-service operation and maintenance.**

**The Institution of Engineers Australia,  
Historic Aircraft Restoration Society  
2016**

(14). For reasons of occupational health and safety, only persons who are in the company of HARS certified guides can be admitted to the static display area.

## 7. References & Acknowledgements:

This submission used information from the following publications, letters DVDs and web-sites:

	Author	Title	Publisher	Repository/ location	Year
1	Gary Squire	Bringing Connie Home	G R Squire	HARS Library/ Archives	2002
2	<a href="#">Peter J. Marson</a>	<a href="#">The Lockheed Constellation Series</a>	<a href="#">Air-Britain</a>	Ron Cuskelly library	1982
3	Curtis K Stringfellow and Peter M Bowers	Lockheed Constellation	Motorbooks Int Publishers	Gary Squire library	1992
4	Walter J. Boyne	"Beyond the Horizons - The Lockheed Story"			
5	Mark Morgan USAF	Military Service History of 54--157 letter dated 1 March 2016	Private correspondence	HARS Library/ Archives	

### Web sites

1	HARS	<a href="http://hars.org.au">//hars.org.au</a>
2	Ron Cuskelly's	<a href="http://www.adastron.com/lockheed/Constellation/connie.htm">http://www.adastron.com/lockheed/Constellation/connie.htm</a>
3	Pima Air and Space Museum	<a href="http://www.pimaair.org/explore/history">http://www.pimaair.org/explore/history</a>
4	AMRG	<a href="https://en.wikipedia.org/wiki/309th_Aerospace_Maintenance_and_Regeneration_Group">https://en.wikipedia.org/wiki/309th_Aerospace_Maintenance_and_Regeneration_Group</a>
5	Ralph Pettersen	<a href="http://www.conniesurvivors.com">http://www.conniesurvivors.com</a>
6	Lockheed Constellation	<a href="http://www.ruudleeuw.com/connioe_text.htm">http://www.ruudleeuw.com/connioe_text.htm</a>
7	The Museum of Flight	<a href="http://www.museumofflight.org/aircraft/lockheed1049g-Super-Constellation">http://www.museumofflight.org/aircraft/lockheed1049g-Super-Constellation</a>
8	Lockheed Corporation	<a href="https://en.wikipedia.org/wiki/Lockheed_Corporation">https://en.wikipedia.org/wiki/Lockheed_Corporation</a>
9	Lockheed Constellation	<a href="https://en.wikipedia.org/wiki/Lockheed_Constellation">https://en.wikipedia.org/wiki/Lockheed_Constellation</a>
10	Lockheed L-1049 Super Constellation	<a href="https://en.wikipedia.org/wiki/Lockheed_L-1049_Super_Constellation">https://en.wikipedia.org/wiki/Lockheed_L-1049_Super_Constellation</a>
11	Lockheed Constellation Variants	<a href="https://en.wikipedia.org/wiki/Lockheed_Constellation_variants">https://en.wikipedia.org/wiki/Lockheed_Constellation_variants</a>
12	The Legendary Lockheed Constellation	<a href="http://www.historynet.com/the-legendary-lockheed-Constellation.htm">http://www.historynet.com/the-legendary-lockheed-Constellation.htm</a>
13	Davis-Monthan Air Force Base	<a href="https://en.wikipedia.org/wiki/Davis%E2%80%93Monthan_Air_Force_Base">https://en.wikipedia.org/wiki/Davis%E2%80%93Monthan_Air_Force_Base</a>
14	Military Airlift Command	<a href="https://en.wikipedia.org/wiki/Military_Airlift_Command">https://en.wikipedia.org/wiki/Military_Airlift_Command</a>
15	Curtiss-Wright	<a href="https://en.wikipedia.org/wiki/Curtiss-Wright">https://en.wikipedia.org/wiki/Curtiss-Wright</a>
16	Wright R-3350 Duplex Cyclone	<a href="https://en.wikipedia.org/wiki/Wright_R-3350_Duplex-Cyclone">https://en.wikipedia.org/wiki/Wright_R-3350_Duplex-Cyclone</a>
17	Turbocompounds	<a href="https://www.enginehistory.org/Wright/Kuhns/CurtissWrightTC18/TurboCompounds">https://www.enginehistory.org/Wright/Kuhns/CurtissWrightTC18/TurboCompounds</a>
18	Qantas	<a href="https://www.qantas.com">https://www.qantas.com</a>
19	Air National Guard	<a href="https://en.wikipedia.org/wiki/Air_National_Guard">https://en.wikipedia.org/wiki/Air_National_Guard</a>
20		

### DVDs

1	An Affair with Connie	Beyond Distribution	Available from HARS
2	Great Planes - Lockheed Constellation		Available on-line
3	An Affair with Connie - unedited video taken by Jim Marshall and others	A HARS Video Production	

My research on the *Super Constellation* VH-EAG has benefited from the extensive knowledge and experience of many people - in particular Jim Thurstan. Others that contributed were Mark Morgan [Staff Historian, Headquarters Air Mobility Command](#) USAF, HARS President and Chief Pilot Bob De La Hunty, Gary Squire, Ron Cuskelly, and HARS members Jim Marshall, Warren Goodhew, Eric Favelle, Mal Hallows, Martin Hobson, Ian Debenham, and others to whom I owe a great debt of thanks.

I have also drawn on the knowledge Ralph Pettersen, a recognised world expert in *Lockheed Constellation* aircraft, who has been unstinting in his help and from various websites - this material has been, to some extent, rewritten and incorporated into this document.

Michael Clark has again demonstrated his skill with the English language, for which I am grateful.

Apart from photos taken by the author, except were noted, the other [photographs are from the personal collections](#) of Ron Cuskelly and Jim Thurstan with several from web sites.





**HISTORICAL AIRCRAFT RESTORATION SOCIETY Inc.**

ABN 13 294 026 266

Bob D. La Hurty, OAM  
President & Chief Pilot

Engineers Australia – Sydney Division  
Engineering Heritage Committee – Sydney

Attn. Doug Bolcyn  
10 Noel Street  
NORTH WOLLONGONG NSW 2500

Dear Doug,

**Engineering Heritage Recognition of *Super Constellation* VH-EAG**

I refer to your letter dated 21 January 2016 and advise that the Historical Aircraft Restoration Society Inc. consents to the Society's Lockheed Constellation, VH-EAG, being formally recognised by Engineers Australia under its Engineering Heritage Recognition Program for its significant engineering heritage value and international importance.

Such recognition would be an honour that will increase public awareness of the heritage significance of 'Connie' and the important role that engineering has played in her restoration.

HARS looks forward to the nomination being successful.

In agreeing to the recognition, HARS acknowledges that it will be responsible for organising the recognition ceremony.

The HARS contact person in this matter is Ian Debenham OAM who you are already working with.

I would like to mention I, along with those HARS members who have assisted you in the preparation of the nomination, congratulate you on the thoroughness of your research.

Yours faithfully

Bob D. La Hurty OAM  
President and Chief Pilot

Hawsons Regional Airport, Box A Road and Roomerang Drive Albion Park Rural, NSW 2527  
Telephone: (02) 4257 4353 Facsimile: (02) 4257 4368 Website: [www.hars.org.au](http://www.hars.org.au)

## Appendix 2 History Time Line of VH-EAG and HARS

Note: refer Appendix 9 for explanation of acronyms

Date	Occurrence	Comment
6 October 1955	Delivered to USAF as Identification No 54-157	Subsequently served with 1608 ATW, MATS Atlantic Division, Charleston South Carolina
25 July 1962	Transferred to Mississippi Air National Guard [183 ATS, Jackson Mississippi]	
1 January 1966	Transferred to 183 MAS	
14 Feb 1967	Transferred to West Virginia Air National Guard	167 MAS. Martinsburgh, West Virginia
Mid 1972	Transferred to Pennsylvania Air National Guard	
28 March 1977	Arrived at MASDC Davis Monthan	193 Tactical Electronic Warfare Squadron, Middletown-Olmstead assigned MASDC Production Control Number AACK0201
5 Nov 1977	Last periodic inspection of the aircraft	
Early 1980s	Initial thoughts on restoring a <i>Super Constellation</i> promoted by Ron Cuskelly	Last remaining ex QANTAS <i>Super Constellation</i> L1049 VH-EAB now owned by Lanzair [Channel Islands N11SR impounded by Kuwait
2 May 1982	N11SR auctioned and bought by Kuwait Ministry of Defence for training purposes	Effectively destroyed in First Gulf War 1991
June 1982	John Ward Director of Public Affairs Qantas offers continuing support for acquisition and return of a suitable <i>Super Constellation</i> to Australia	
	A request was made for the Indian Government to donate one of their L1049G <i>Super Constellations</i> as a bi-centennial gift with QANTAS effecting the purchase and restoration costs	QANTAS was not receptive to this idea
1986	A decision was taken by the Federal Government that a National Aviation Museum of Australia [NASMA] should be set up and its home should be in Victoria, in a location to be decided by the Victorian Government	NSW would be offered the National Maritime Museum
December 1991	Inspected at Davis-Monthan AFB by HARS members	
April 1992	HARS and NASMA people visited USAF Museum Dayton Ohio to discuss acquiring 54-0157	
17 April 1992	54-0157 towed to Pima Air and Space Museum where the restoration by HARS was to be undertaken	
Late May 1992	third trip	
March 1993	Agreements signed off between USAF Museum and Museum of Victoria and Museum of Victoria and HARS In addition to 54-0157 the agreements included an Ek-121K Warning Star 141311 c/n4435	
22 April 1993	First Engine runs and on 25th the second engine runs	
23 Jan 1994	CASA issues a Special Certificate of Airworthiness - Aircraft No BK10793	
June 1994	All engines run at full power	
June 1994	Undercarriage retraction tests	
3 Aug 1994	USAF Museum sells 54-0157 to NASMA [Museum of Victoria]	
??	Fitted with wing-tip tanks	

23 Sept 1994	First flight from Davis-Monthan AFB to Tucson International Airport [as N4115Q]	
25 Sept 1994	Two test flights from Tucson and placed in Lockheed Aeromod Center to be cleaned and repainted in its new livery	
23 Sept 1994	Registered VH-EAG by CASA	
	3 training flights from Tucson	
	Disaster - a suspect engine that was later exchanged for a serviceable one	
23 Nov 1994	CAA advised the US authorisation to fly VH-EAG to Australia was invalid	
Early Sept 1994	CASA approves the resumption of flying and crew training aboard VH-EAG	
	HARS obtains operations manual from defunct US <i>Constellation</i> operator, which provided FAA-approval data accommodating civil certification of the military model L1049F [C121C]	
14 Dec 1995	CASA Special Delegate issue Australian Special Category Certificate of Airworthiness	
23 Jan 1996	Certificate co-signed by ?? Maintenance Release signed by Jim Thurstan	
???	Qantas declares HARS facility at Sydney Airport an 'Approved Workshop'	
23 Jan 1996	Departed Tucson International Airport Arizona for staged flight to Australia	
23 Feb 1996	Lands at Oakland California 1 day stopover to repair minor fuel leak	
25 Feb 1996	Lands at Honolulu 1 day break	
27 Feb 1996	Departs Honolulu pre dawn Lands at Pago Pago American Samoa	
28 Feb 1996	Lands at Nandi Fiji 3-day break	
03 Feb 1996	Arrived Sydney Airport 1145am	
23 Jun 1996	CASA issues a Special Certificate of Airworthiness	
21 Feb 1997	Ownership passed from Museum of Victoria to HARS	
07 Nov 2002	Flown to new HARS base at Albion Park	

### Appendix 3 Images of VH-EAG and other *Constellation* Aircraft



VH-EAG taking off Illawarra Regional Airport



VH-EAG in HARS Hangar Illawarra Regional Airport





**VH-EAG cockpit**



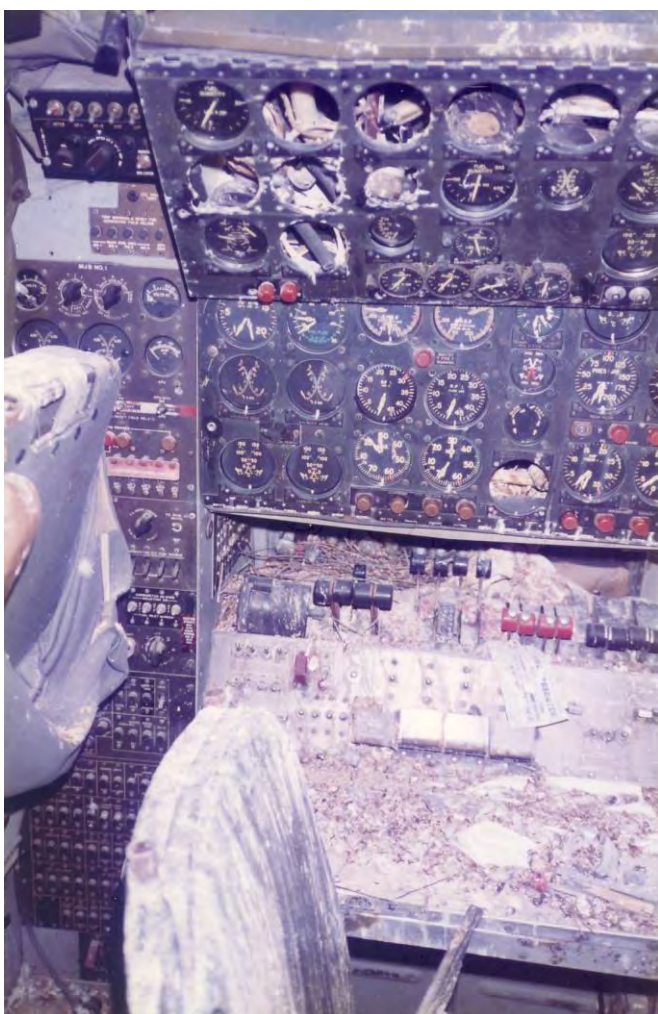
**VH-EAG Flight Engineers Station**





**A Super Constellation at Davis Monthan Air Force Base 1992**

Photo Jim Thurstan



**54-0157 Flight Engineers Station 1992 note bird droppings**

Photo Jim Thurstan



Corpor

**VH-EAG Cabin**



**VH-EAG at Lockheed Corporation Aeromod Centre freshly painted in Qantas Livery**





**L749 Lockheed *Constellation* - built as C-121A**



**L049 Lockheed *Constellation* - built as C-69 which preceded the L749**



**L1649 Lockheed Starliner**

also watch

<https://www.youtube.com/watch?v=v0iEqLorxF4>

<https://www.youtube.com/watch?v=gMSnc01CutI>

<https://www.youtube.com/watch?v=UZYCnR6vKFU>

<https://www.youtube.com/watch?v=CtdDWB9pj7A>

Breitling Super Constellation

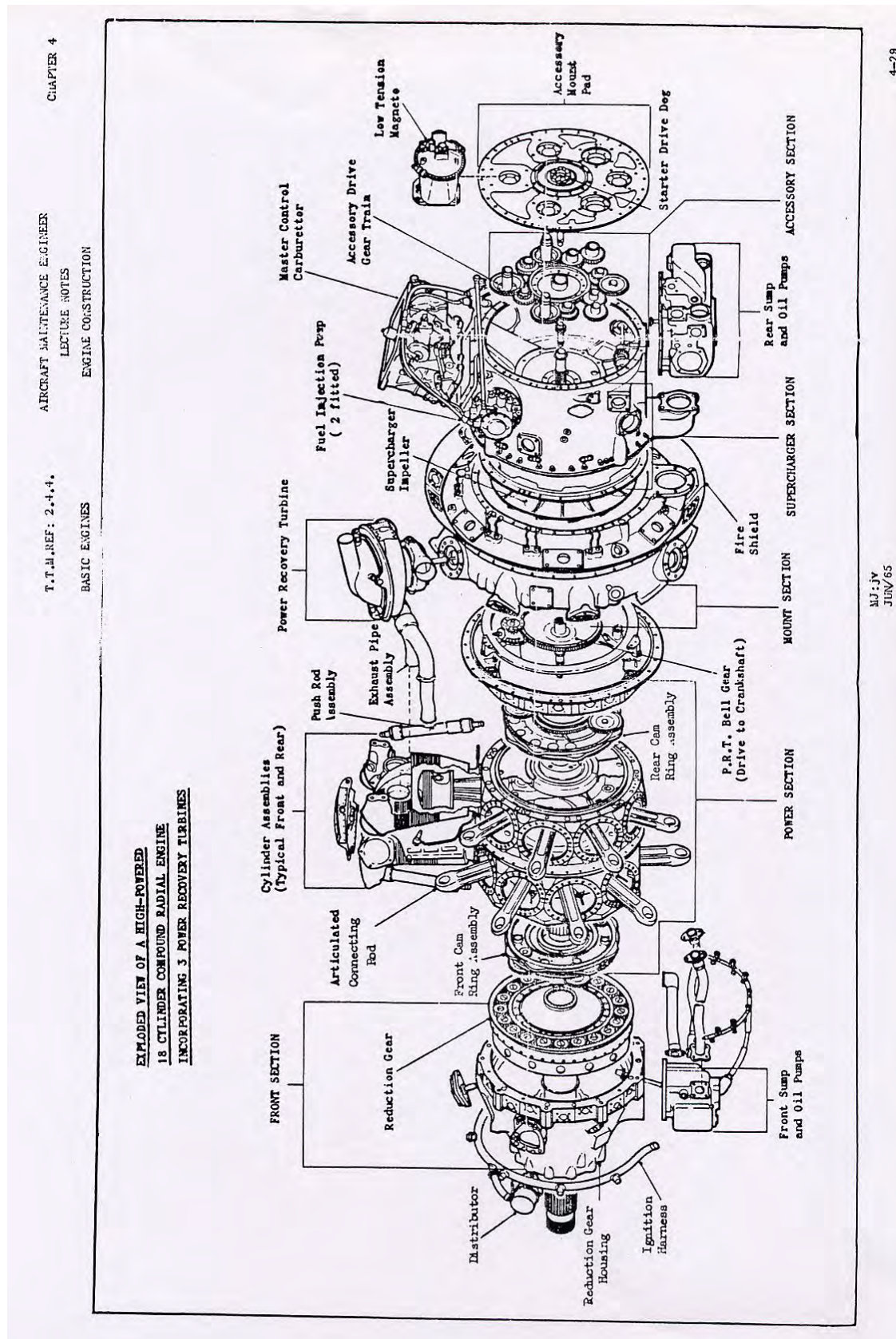
<https://www.youtube.com/watch?v=UTmgaaq8sMc>

1955 promo film



## Appendix 4 Drawings of VH- EAG

HARS does not hold any original design drawings but it does hold many detail drawings in manuals for the aircraft.





## Appendix 5 Statistics VH-EAG- Lockheed L1049-F -55-96 / C-121C Super Constellation & Wright R3350 - 93A Engine

Comment: the performance figures are not the manufacturers figures but are estimates by the aircraft's engineers for the aircraft using low octane 100/130 avgas

<b>Length</b>	35.4 m [116ft 2in]	
<b>Wing Span</b>	over wing tips	37.5 m [123ft]
	over wing tip tanks	37.6m <i>fitted to VH-EAG but not standard on C121C</i>
<b>Height</b>	top of fuselage	5.73m [18ft 10in]
	top of fins	7.54m [24ft 9in]
<b>Width of Fuselage [max]</b>	3.53m [11ft 7in]	
<b>Empty Mass</b>	33028kg [7285lb]	
<b>Maximum Cruise Speed</b>	480km/h	[300mph [260kt]]
<b>Landing Approach Speed</b>	~185 km/h	[115mph]
<b>Stall Speed</b>		
•	Landing configuration	153km/hr [96mph (83kt)]
•	Clean	194km/hr [119mph (104kt)]
<b>Maximum Range</b>	5560kms [3,450mls, 2,996nm]	
<b>Maximum Endurance</b>	16.5 hrs	
<b>Maximum Cruise Ceiling</b>	7620 m [25,000ft] <i>pressurised</i>	
<b>Maximum Take Off Weight</b>	<i>all up weight [AUW]</i>	
	•115/145 Octane (Unavailable)	62,370kg [137,500lbs]
	•100/130 Low Lead Fuel	54,545kg [120,000lbs]
<b>Maximum Landing Weight</b>		
	•115/145 Octane Fuel (Unavailable)	51,256kg [113,000lbs]
	•100/130 Low Lead Fuel	46,039kg [101,500lbs]
<b>Maximum Fuel Capacity</b>	24,790L	[5,453 Imp gal]
<b>Total Engine Oil Capacity</b>	830 L	[186 Imp gal]
<b>Crew</b>		
	Civil Version	5 technical and 4 cabin
	Military Version	4 technical and 1 cabin
<b>Passengers</b>		
	Civil Version	59-87 Qantas configuration
	Military Version	Up to a maximum of 106
<b>Engines</b>	Four turbo-compound, air-cooled, double row, 18-cylinder, radial aircraft engines with 3 power recovery turbines	

Civil Version	4 Wright TC18 - EA3
Military Version	4 Wright R3350 - 93A

military designation R-3350, the ultimate version of the engine which powered the Qantas *Super Constellations G* and *H* models was more correctly known by its civil designation of 972TC18-DA3 or just DA3 for short).

<b>Power Plant Weight</b>	2,702kg [4,568 lbs]	
<b>Displacement</b>	55L	[3,350 cu in]
<b>Maximum Power</b>	100/130,Low,Lead,Fuel	2,148kW [2880hp]
<b>Cruise Power</b>	[Typical at 200 knots]	1080kW [1450hp]
<b>Fuel Consumption</b>	[Per hour/engine at cruise	445L [100Imp.gal]
<b>Oil Consumption</b>	[Per hour/engine at cruise]	9L [2Imp.gal]
<b>RPM</b>	Take Off 2900rpm Cruise Typical 2200rpm Idling 800rpm	
<b>Maximum MAP [Manifold Pressure]</b>	100/130 Low-Lead Fuel	52"Hg

#### Other Important Information

Each engine has 3 exhaust powered recovery turbines delivering 112kW [150hp] each (at take off)

<b>Overhaul Life</b>	<i>Subject to condition, but generally:</i>	
HARS	2400 hours	[Wright standard]
US Air Force	2700 hours	
US Navy	3400 hours	
Propellers	Hamilton standard Hydromatic 43H 60 3 blade [aluminium] constant speed, full feathering, reversible Swept diameter. 15ft 1 inch [4.6m]	
Propeller rpm	Approximately half engine speed	
Credited Flying Hours	as 54-0157	18452 hours
	as VH-EAG	604 hours

Source Ref 1 and May 1, 2009 HARS web site and discussions with HARS LAMEs

**Wright R3350 Duplex Cyclone Radial Aircraft Engine** *see also Appendix 10***Introduction**

The Wright R-3350 Duplex-Cyclone was one of the most powerful radial aircraft engines of its day. It was manufactured in the United States. The engine was a twin-row, *Supercharged*, air-cooled, radial engine with 18 cylinders. Power output ranged from 2,200 to over 3,700 hp [1,640 to 2,760 kW], depending on the model and the fuel. Developed before World War II, by Curtiss-Wright, Wright Aeronautical Division the R-3350's design required a long time to mature before finally being used to power the Boeing B-29 *Superfortress* and later the Lockheed *Super Constellation*. After the war, further development of the engine's design – notably in its turbo-compound forms, made it the engine of choice to power most of the large civilians of the day.

The goal of high horsepower and excellent fuel efficiency was achieved with the use of a process called turbo-compounding, which used the high velocity exhaust gases from 6 of the 18 cylinders to drive three ram air cooled turbines that transferred the energy produced to the propeller shaft generating over 20% additional take-off power without increasing fuel consumption. Allison, Pratt & Whitney and Napier all carried out developmental work with the turbo-compounding concept. Wright was the only aircraft engine manufacturer to put a turbo-compound engine into production.

Many thousands of the R3350 engines were built over the 1940s and 1950s

**Specification for the R3350-93A [The civil version of this piston-driven engine is TC18EA3]**

**Type:** twin row 18 cylinder turbo compound *Supercharged* radial engine

**General characteristics**

- **Type:** Twin-row 18-cylinder radial engine
- **Bore:** 6 1/8 in [155.6 mm]
- **Stroke:** 6 5/16 in [160.2 mm]
- **Displacement:** 3,347 in<sup>3</sup> [54.86 L]
- **Length:** 76.26 in [1,930 mm]
- **Diameter:** 55.78 in [1,420 mm]
- **Dry weight:** 2,670 lb [1,212 kg]

**Components**

- **Valve train:** Pushrod, two valves per cylinder
- **Supercharger:** Two-speed single-stage
- **Fuel system:** Chandler-Evans downdraft carburetor
- **Fuel type:** Was 115 /145 octane now 100/130 octane avgas
- **Oil system:** Dry sump
- **Cooling system:** Air-cooled
- **Power recovery turbines:** 3 at 120deg 150 HP each at take-off power.  
Fluid coupled to crankshaft

**Performance** *based on 100/130 avgas fuel*

- **Power output:** 2,880 hp at 2,900 rpm (takeoff power)
- **Specific power:** 0.66 hp/in<sup>3</sup> [ 0.030kW/cu cm]
- **Compression ratio:** 6.85:1
- **Power-to-weight ratio:** 0.82 hp/lb [0.278.kW/kg]





Wright R-3350 Turbo-Compound radial engine fitted at the Number Four position on the starboard wing of a Lockheed *Super Constellation*

### Variants

- **R-3350-13** : 2,200 shp (1,640 kW)
- **R-3350-23** : 2,200 shp (1,640 kW)
- **R-3350-24W** : 2,500 shp (1,860 kW)
- **R-3350-26W** : 2,800 shp (2,090 kW)
- **R-3350-32W** : 3,700 shp (2,760 kW)
- **R-3350-34** : 3,400 shp (2,540 kW)
- **R-3350-42WA** : 3,800 shp (2,830 kW)
- **R-3350-53** : 2,700 shp (2,010 kW)
- **R-3350-57** : 2,200 shp (1,640 kW)
- **R-3350-85** : 2,500 shp (1,860 kW)
- **R-3350-89A** : 3,500 shp (2,610 kW)
- **R-3350-91**
- **R-3350-93W** : 3,500 shp (2,610 kW)
- **R-3350-93A**

According to Marson's book Ref 2,, the R-3350-91 was first fitted to the C-121C but these engines were later modified to R-3350-93 and R-3350-93A.

### Major Applications

- Boeing B-29 *Superfortress*
- Boeing XC-97 Stratofreighter
- Douglas DC-7
- Fairchild C-119 Flying Boxcar
- Lockheed *Constellation*
- Lockheed L-049 *Constellation*
- Lockheed C-69 *Constellation*
- Lockheed L-649 *Constellation*
- Lockheed L-749 *Constellation*
- Lockheed L-1049 *Super Constellation*
- Lockheed C-121 *Constellation*
- Lockheed R7V-1 *Constellation*
- Lockheed EC-121 Warning Star
- Lockheed L-1649A Starliner
- Lockheed P-2 Neptune

The R3350 engine was designed to use high-octane 115/145octane heavily leaded avgas which is no longer available

Source: Wikipedia Wright R-3350 Duplex Cyclone  
Turbo compounds Karl Kukns

*Comment:*

In commercial operation, engines often failed under heavy demands - heavy loads, steep take off, maintaining cruising top speed. As a result, the *Super Constellation* often flew on only three of its four engines and was referred by flight crews and maintenance engineers to as the best tri-motor aircraft around.

In its later life, the source of the engine failure problem was found and designed out.

## Appendix 6 - History and Table of Lockheed Manufactured *Constellation* Aircraft Models

### History of Lockheed *Constellation*

The Lockheed *Constellation* was a large propeller-driven, four-engine aircraft that was built by the Lockheed Corporation between 1943 and 1958 at Burbank, California.

Lockheed built 856 in numerous models - see *below*, all with the same triple-tail design and dolphin-shaped fuselage. Most were powered by four 18-cylinder Wright R-3350 Duplex-Cyclones radial engines. The *Constellation* was used as a civil airliner and as a high-speed, long-range military and civil air transport, seeing service in World War 2 and Viet Nam, the Berlin Airlift and the Biafran airlift. The VC 121E variant was the presidential aircraft of choice for US President Dwight D. Eisenhower.

All told, the U.S. military bought nearly 40 percent of all the *Constellations* ever manufactured, using them over three decades, with aircraft serving well into the 1970s

### Development of the *Constellation*

Lockheed had been working on the design for the L-044 Excalibur, a four-engine pressurized airliner, since 1937. In 1939 Trans World Airlines, at the instigation of its President and major stockholder Howard Hughes, requested a 40-passenger, [US] transcontinental airliner with a 3,500 mile [5,630 km] range — well beyond the capabilities of the Excalibur design.

Lockheed took the opportunity to design the sleek, distinctive, now-iconic aircraft, to meet TWA's requirements. Lockheed introduced new features previously unseen on passenger planes such as the first hydraulically boosted controls and a de-icing system used on wing and tail leading edges. And, using award-winning technology pioneered by Lockheed a few years earlier, it would feature a pressurized cabin for 44 passengers that allowed the plane to fly faster and above 90 percent of weather disturbances, what *Constellation* regulars would come to call 'smooth sailing'. In the years to come, the plane would be named the *Constellation*—Connie for short—and be flown by airlines around the world, as well as the U.S. military over the ensuing three decades. Eventually, it would be remembered as an enduring symbol, the epitome of grace in propeller-driven aircraft.

The *Constellation's* wing design was adopted from the P-38 Lightning fighter that had been developed by Lockheed, differing mostly in size. The triple tail - probably the aircraft's best known feature, kept the aircraft's height low enough to fit in existing hangars. The aircraft had a maximum speed of over 375 mph [600 km/h], faster than that of a Japanese Zero fighter, a cruise speed of 355 mph [550 km/h], a service ceiling of 24,000 ft [7,300 m] and a range of 2000 miles [3200km]..

### World War 2

The Lockheed's design - L1049 model quickly caught the attention of the U.S. military, readying for war, who saw its potential as a fast transport for troops and supplies to Europe non-stop and took over production in 1942. The TWA aircraft entering production were converted to an order for C-69s. *Constellation* military transport aircraft, with 202 aircraft intended for the United States Army Air Forces [USAAF]. The first prototype flew on January 9, 1943, a short ferry hop from Burbank to Muroc Field for testing.

The C-69 was mostly used as a high-speed, long-distance troop transport during the war. A total of 22 C-69s were completed before the end of hostilities, but only 13 of these entered military service. The USAAF cancelled the remainder of the order in 1945. However, some aircraft remained in USAF service into the 1970s, serving as passenger ferries for the airline that relocated military personnel, and carrying the livery of MATS [Military Air Transport Service].

### Post War - Military Use

While only 22 *Constellations* [C-49 and C-149] were built during World War 2 - Lockheed was

asked, instead, to focus on the P-38 interceptor. The Army, Air Force, and Navy had recognized the *Constellation's* versatility. By 1948, the Navy was calling in orders for *Constellations* to act as long-range patrol aircraft. In time, *Constellations* would be used in theatres of war around the globe such as Korea and *Super Constellations* used for Viet Nam for ferrying men and materials and medical evacuations. Other uses included the delivery of supplies to occupied Europe breaking the USSR imposed Berlin blockade and everything from rescue missions VIP transports to airborne early warning missions and the mapping of the earth's magnetic field.

Its area of distinction, however, was clearly airborne command and control and early warning. During the Viet Nam War, *Constellations* were flown in elliptical orbit near enemy territory to collect and transmit information on air activity. *Constellations* were also the first planes to carry rotating radomes, saucer-shaped domes used to protect radar antennas, a technology that is still in use with modern aircraft controlling the skies over the Middle East and with US Customs and Border Protection P-3s running drug interception missions in the Caribbean.

### Post War - Civilian Use

After World War 2 the *Constellation* came into its own as a fast civil airliner. Aircraft already in production for the USAAF as C-69 transports were completed as civil airliners, with TWA receiving the first on 1 October 1945. TWA's first trans-Atlantic proving flight departed on 3 December 1945.

The *Super Constellation* was designed to change the face of commercial flight. However, there were issues during its infancy in relation to its power plant. Lockheed was flexing the limits of piston-engine technology, and the engine's complex design required maintenance, and sometimes regular replacement of short-life parts, at rates that would be considered unacceptable with the forthcoming introduction of jet aircraft.

In 1951, the Model 1049 *Super Constellation* was unveiled, boasting unheard-of refinements, such as air conditioning, reclining seats, and extra lavatories. It was a plane ahead of its time, at least twice as fuel efficient as the industry's first jets and as efficient as many of today's modern aircraft.

As the world's first pressurized airliner in widespread use along with the Boeing 307 Stratoliner, the *Constellation* helped to usher in affordable and comfortable air travel. Operators of *Constellations* included the airlines of the USA, France, Britain, Netherlands, Australia [Qantas], Germany, Spain, Brazil, Portugal Canada, Ireland to name a few.

Eisenhower was a big fan of the Connie, and his personal presidential plane, the only VC-121E built, was the first to bear the now-recognized moniker "Air Force One" when the president was onboard.

### Obsolescence

The advent of the first generation jet airliners such as the de Havilland Comet, Boeing 707, Douglas DC-8 and Convair 880, saw the piston-engined, propeller-driven *Constellation* displaced from the premier long-haul services and relegated to secondary routes and lesser functions. The first routes lost to jets were the long overseas routes, but *Super Constellations* continued to fly domestic routes.

For all intents and purposes, commercial operation of the *Super Constellation* ceased in 1993 when the FAA forbade Dominican operators from operating their aircraft in the United States. The USAF flew the *Super Constellation* into the early 1980s with the US Navy retiring its last aircraft in June 1982.

### A New Age Beckons

The final commercial *Constellation* was produced in 1959. By then, the planes had flown for most of the world's major airlines and been used by militaries across the globe. And yet the versatile airframe would continue to be adapted for a variety of unforeseen roles, from chartered operations and freighters where their low speed was not an impediment, to agricultural crop sprayers. Over the years, its stature as one of the most graceful aircraft of early commercial

flight would only intensify, as evidenced by the number of Connies found in aviation museums around the world

With the cessation of *Constellation* production, Lockheed elected not to develop a first-generation jetliner, instead sticking to its lucrative military business and production of the modest turboprop-powered Lockheed L-188 Electra airliner.

Lockheed would not build a large civil passenger aircraft again until its L-1011 Tristar debuted in 1972. While a technological marvel, the L-1011 was a commercial failure, and Lockheed left the commercial airliner business permanently in 1983.

## **The Family of *Constellations***

### **L649 and L749 *Constellation***

The L649 and L749 were the first true commercial *Constellations* and received their type certificate in March 1947. Essentially an iterative development of the L049, the type certificate was an "add-on" to the L049 certificate. Delivery of the first L649 went to Eastern Airlines in May 1947 with Air France receiving the first L749 a month earlier in April 1947. The L749 was essentially a L649 with an additional 1,130 gallons [4,378L] of fuel for longer range. Only fourteen L649's and six L649A's were produced. Most aircraft were upgraded to L749A standards sometime during their lifetime. In 1947, with orders for the *Constellation* at low ebb, Lockheed was considering cancelling the project. The US Air Force placed an order in September 1947 for ten C-121A/B's, essentially L-749's, which kept the production line going until more civilian orders were forthcoming.

### **L1049 *Super Constellation***

A total of 579 *Super Constellations* were built between 1951 and 1959 with 259 going to commercial operators and 320 to the US military. The US Navy was the largest operator of *Super Constellations* with a total of 204 transport and early warning radar aircraft. As early as 1949 Lockheed considered stretching the *Constellation* by 5.5 metres by inserting constant diameter fuselage plugs forward and aft of the wing. In order to expedite the development, the first *Constellation* c/n 1961 was purchased from TWA - Howard Hughes in May 1950 for US\$100,000 and modified as the *Super Constellation* prototype. Still powered by the Pratt and Whitney R2800 engines installed in 1945, the prototype made its first flight on 13 October 1950. After twenty-two hours of flight testing, R3350 engines were installed and the vertical stabilisers were enlarged by 0.46m to increase the directional stability.

The *Super Constellation* incorporated over 550 design changes and the first production aircraft flew on 14 July 1951. The type certificate was awarded on 29 November 1951. Prior to 1953 all turbo-compound R3350 engines were earmarked for military use and the L1049 had to settle for 2,700hp [2012kW] CA1 engines which made it underpowered

The Navy's R7V-2 transport, first flown in November 1952, as the first *Super Constellation* to utilise the turbo-compound R3350 engine. Turbo-compound engines became available for commercial use in early 1953 and 3,250hp [2,421kW] - using 115/140 avgas, DA1 engines were first installed on L1049C *Super Constellation* PH-TFP, which was delivered to KLM on 10 June 1953. Later developments included twin 600-gallon [2,271L] wing-tip tanks on civilian L1049G and Hs and on military early warning radar *Super Constellations* resulting in an extended range for these aircraft. The 3,400hp [2,533kW] and EA6 versions of the R3350 engine were installed on the L1049H cargo versions of the *Super Constellation*.

The "Super G" was the most successful version of the Lockheed *Super Constellations* and one of the last great piston-engine airliners. Soon after the plane's introduction, it became clear that airlines would invest in jet aircraft for reasons of economy and speed. For long-range operations, the *Super G* could be fitted with extra wing-tip tanks increasing the fuel capacity by two-thirds more than the original L1049C variant. The first flight of the G-*Constellation* was on December 7, 1954 and it was introduced to commercial service on July 1 1955. The *Super G* was a popular choice among the airlines with 42 being flown by [US] domestic carriers and 59 by [US] foreign airlines.

**L1649A Starliner**

The L1649A *Starliner* was the outgrowth of the L1469/L1569 turboprop designs studied by Lockheed but never commercially produced. Development of the L1649A began in May 1955 and was Lockheed's response to the long range Douglas DC-7C that went into service in June 1956. The *Starliner* incorporated a totally new wing design, 3,400 hp [2536kW] –EA2 turbo compound engines and a fuel capacity of 9,000 gallons [3,4875L] giving it a range of over 5,000 miles [8,000km].

The first flight of the prototype was October 10, 1956 with TWA introducing the L1649A on its North Atlantic service on June 1, 1957. Sadly, this superb aircraft was developed too late and was quickly overshadowed by the early jets with only forty-four being produced. TWA was the largest operator with twenty-nine aircraft with Lufthansa and Air France also taking delivery of the new aircraft. Most were out of front-line passenger service by 1963 with a number being converted to freighters and many going to second-tier operators and travel clubs

*On 27 July 1949 the deHavilland Comet made its first flight in England. This marked the beginning of the end of the piston-driven airliners.*

Source Lockheed website

**List of Constellation Models Built by the Lockheed Corporation**

Note: Refer Appendix 10 for list of aircraft built by the Lockheed Corporation

Model	Name	First flight	Remarks
44	Excalibur	<i>Design abandoned</i>	four-engine predecessor to <i>Constellation</i>
049	<i>Constellation</i>	January 9, 1943	original passenger version 88 built as C69 22 as military and balance for airlines post 1945
149	<i>Constellation</i>	<i>None built</i>	
L-349	<i>Constellation</i>	<i>None built</i>	Company designation of C-69B long range troop/cargo transport
L-449	<i>Constellation</i>	<i>None built</i>	unknown proposed civilian airliner variant
L-549	<i>Constellation</i>	?? 1945	Company designation for C-69C 43 seat VIP transport 1 built
L-649	<i>Constellation</i>	October 18, 1946	improved passenger variant of 049 with strengthening of internal wing structure, landing gear and other improvements R-3350-749C18BD engines with 2,500hp [1,865kW] each, seating for up to 81, 14 built
L-649A	<i>Constellation</i>		Reinforced landing gear and fuselage 6 built
L-749	<i>Constellation</i>	March 14, 1947	L-649 with added fuel capacity was capable of non-stop Transatlantic flights 59 L-649/L749 built and 59 L-749 built Body of 049 extended by 18ft {5.5m}
L-749A	<i>Constellation</i>	March 14, 1947	Reinforced landing gear and fuselage
L-749B	<i>Constellation</i>	<i>None built</i>	Turbine powered. Project cancelled due to the absence of a suitable power plant
L-849	<i>Constellation</i>	<i>None built</i>	Planned version of L-749, which would have had a Wright R-3350 turbo compounds
L-949	<i>Constellation</i>	<i>None built</i>	Speed freighter combi version
L-1049	<i>Super Constellation</i>	First flight prototype 13 Oct 1950 First flight production model July 14, 1951	First production version, 24 built. An 18ft 4in [5.6m] stretched version with a maximum capacity of 109 passengers, square windows. All L-104C and later models had a turbo-compound engines. Some later models had optional wing tip tanks. 579 built, including military versions
L-1049A	<i>Super Constellation</i>	<i>None built?</i>	Company designation for the WV-2, WV-3, EC-121D and RC-121D
L1049B	<i>Super Constellation</i>	<i>None Built?</i>	Company designation for the R7V-1, RC-121C and VC-121E

<b>L-1049C</b>	<i>Super Constellation</i>	March 17 1953	Civil variant of the L-1049B for 110 passengers with four R-3350-87TC18DA-1 Turbo compound engines with 3250hp [2,425kW each] 48 built
<b>L-1049D</b>	<i>Super Constellation</i>	Aug 1954	Freight variant of L1049B with wing and fuselage modifications and a large cargo door - 4 built
<b>L-1049E</b>	<i>Super Constellation</i>		Passenger variant of L-1049D length extended by 18ft 4.75ins inc passenger capacity from 62 to 92 28 built
<b>L-1049F</b>	<i>Super Constellation</i>		Company designation for the military variant C-121C 33 built and 1 converted. There was never a civil variant
<b>L-1049G</b>	<i>Super Constellation</i>	Dec 17 1954	Advanced variant with four R-3350-972TC18DA-3 engines with higher METO power, ability to carry wingtip fuel tanks 102 built
<b>L-1049H</b>	<i>Super Constellation</i>	Nov 20 1956	Passenger/ freight convertible variant of L-1049G with large cargo doors 53 built Qantas' first Super Constellation
<b>L-1049J</b>	<i>Super Constellation</i>	<i>None built</i>	Planned L-1049G with wings of R7V-2
<b>L-1149</b>	<i>Super Constellation</i>	<i>None built</i>	A planned Allison turboprop powered version of the model L-G and L1049H
<b>L-1249</b>	<i>Super Constellation</i>	September 1, 1954	experimental turboprop military transport version
<b>L-1249A</b>	<i>Super Constellation</i>		Company designation for the R7V-2and YC-121F
<b>L-1249B</b>	<i>Super Constellation</i>	<i>None built</i>	Planned turboprop passenger version of the R7V-2 YC-121F
<b>L-1449</b>	<i>Super Constellation</i>	<i>None built</i>	Proposed turboprop version of the L-1049G with stretched fuselage and larger wings
<b>L-1549</b>	<i>Super Constellation</i>	<i>None built</i>	Planned stretched version of the L-1449
<b>L-1649A</b>	Starliner	October 11, 1956	Production version, R-3350-988TC18EA-2 Turbocyclone engines with 3,400hp [2,356kW] each The standard radome for the weather radar extended the total length of the fuselage by 2ft 7ins [0.78m] over the L-1049 without radome. New thin-section wing with a straight taper, and much a-larger fuel capacity giving a ferry range of over 6,880 miles [11,080km] 44 including the prototype were built

Source 1. Breffort, Dominique. Lockheed *Constellation*: from Excalibur to Starliner Civilian and Military Variants. Paris: Histoire and Collections, 2006. Print. ISBN 2-915239-62-2

2. [The Lockheed Constellation Series" by Peter J. Marson \(Air-Britain 1982\)](#)

**Appendix 7 List of Constellations and Super Constellations that were in service with Qantas.**  
*Listed in order of delivery to Qantas*

Model	Company Number	Australian Registration Number		Date Handed Over	Date Sold	Comments
<b>Constellations</b>						
L749-79-31 L749A-79	2562	VH-EAA	Ross Smith	14 Oct 1947	15 Feb 1955	Sold to BOAC G-ANUP
L749-79-31 L749A-79	2565	VH-EAB	Lawrence Hargreave	22 Oct 1947	26 Feb 1955	Sold to BOAC G-ANUR
L749-79-31 L749A-79	2572	VH-EAC	Harry Hawker	22 Oct 1947	8 Oct 1955	Sold to Aerovias Guest Mexico XA-LIO
L749-79-31 L749A-79	2573	VH-EAD	Charles Kingsford Smith	27 Oct 1947	8 Oct 1955	Sold to Aerovias Guest Mexico XA-LIP
L749-79-35 L749A-79	2505	VH-EAE	Bert Hinkler	17 Jan 1950	23 July 1954	VT-CQR Raiput Princess purchased from Air India. Sold to BOAC G-ANTG
L749-79-35 L749A-79	2504	VH-EAF	Horace Brinsmead	April 1951	July 1954	VT-CQR Mogul Princess purchased from Air India Sold to BOAC G-ANTF
<b>Super Constellations</b>						
L1049C-55-81 L1049E-01-55	4539	VH-EAG	Southern Constellation	15 April 1954	3 May 1963	Scrapped Burbank 1965
L1049C-55-81 L1049E-01-55	4545	VH-EAH	Southern Sky	28 April 1954	9 Nov 1959	Sold to Lockheed
L1049E55 L1049E-01-55	4546	VH-EAI	Sthn Melody Sthn Sun Sthn Boomerang	24 May 1954	1 Dec 1959	Traded in for down payment on Electras Leased back to Qantas Nov 1960-Mar 1961 cargo
L1049E55 L1049E-01-55	4549	VH-EAJ	Sthn Star	5 July 1954	5 Jan 1960	Sold to Lockheed
L1049E-55 L1049E-01-55	4573	VH-EAK	Sthn Mist	17 Jan 1955	2 Feb 1963	Sold to Boeing
L1049E-55 L1049E-01-55	4574	VH-EAL	Sthn Breeze	31 Jan 1955	11 Nov 1959	Sold to Lockheed
L1049E-55 L1049E-01-55 L1049G	4578	VH-EAE	Sth Moon	8 Feb 1955	8 Mar 1960	Sold to Lockheed
L1049E-55 L1049E-01-55	4579	VH-EAF	Stn Wind	26 Feb 1955	23 April 1963	Sold to Boeing
L1049E-55 L1049E-01-55 L1049G Then H - cargo door	4580	VH-EAA*	Sthn Sea	8 Mar 1955	24 Mar 1963	Mar 1960-Jan 1963 cargo
L1049E-55 L1049E-01-55 L1049G Then H - cargo door	4581	VH-EAB*	Sthn Horizon	8 Mar 55	24 Mar 63	Jul 1960-Mar 1963 cargo
L1049E-55 L1049E-01-55 L1049G	4606	VH-EAC*	Sthn Wave	25 Oct 1955	20 Aug 1960	Written off in Mauritius 24 Aug 60
L1049E-55 L1049E-01-55 L1049G	4607	VH-EAD*	Sthn Dawn	26 Nov 1955	15 Mar 1960	Sold to Lockheed
L1049H-82-133	4801	VH-EAM*	Sthn Spray	17 Oct 1956	11 July 1962	Sold to Air New Mexico
L1049H-82-133	4803	VH-EAN*	Sthn Tide	20 Nov 1956	11 July 1962	Sold to Air New Mexico
L1049G-82-118	4679	VH-EAO*	Sthn Aurora Sthn Prodigal	28 Oct 1957	14 Oct 1959	Traded in for down payment on Electras in September 1959. Leased back to Qantas Aug 1960-Feb 1962 cargo
L1049G-82-118	4680	VH-EAP*	Sthn Zephyr	5 Dec 1957	25 Oct 1959	

\* fitted with wing-tip tanks as delivered and as part of upgrade to G model EAA to EAE inclusive

Source Ref 1



## Appendix 8 List of L1049 Lockheed Super Constellation Survivors

as at May 2010

**Abbreviations:**

c/n	Comapny number [same as manufacturers serial number]
N	Navy
AFB	Air Force Base
ACW	
BuN	Bureau Number [the US Navy serial number]
CF	Canadian Civil Registration Number
54-180	US Air Force serial number      The aircraft was the 180th aircraft bought under a 1954 contract
VH	Australian Civil Registration Number
F	French Civil Registration Number
D	German Civil Registration Number

Registration	c/n	Where Currently Located	Condition
N105CF	4137	Stored Avra Valley Airport, Arizona	On display
N4247K	4144	Qantas Founders Museum Longreach, QLD, Australia	Being restored
53-7885	4151	National Museum of the USAF, Wright Patterson AB, Dayton, Ohio as "Columbine III"	On display
54-155	4174	USAF History and Traditions Museum Lackland AFB, San Antonio, Texas	On display
HB-RSC	4175	Super Constellation Flyers Association (SCFA), Basel, Switzerland	airworthy
VH-EAG	4176	HARS Albion Park, NSW, Australia	airworthy
54-160	4179	Nose section stores in owner Antti Hyvarinen's backyard in Nukari, Finland	-
N1104W	4196	Washington Udvar-Hazy Centre, Dulles International Airport Chantilly, Virginia	On display
54-180	4199	Transport Aircraft Museum, Charleston, South Carolina	On display
HI-548CT	4202	Cockpit salvaged by the SCFA Basel, Switzerland	Being restored
N4257L	4335	Acquired by Evergreen Air and Space Museum in 2009, Helena, Massachusetts	Stored in good condition
N4257U	4336	Combat Air Museum, Topeka, Kansas	On display
52-3425	4343	Peterson Air and Space Museum, Peterson AFB, Colorado Springs, Colorado	On display
BuN137890	4347	"Connie Park" near 552 ACW Wing Complex, Tinker AFB, Oklahoma	On display
N51006	4350	Pima Air and Space Museum, Tucson, Arizona - forward fuselage section to be transported to Australia for restoration	scrapped
N548GF	4363	Yanks Air Museum, Chino, California	On display
53-554	4369	Pima Air and Space Museum, Tucson, Arizona	On display
53-555	4370	National Museum of the USAF, Wright Patterson AFB, Dayton Ohio	On display
Bun 141292	4416	Forward fuselage section stored at private residence, Stanley, North Carolina	-
BuN141297	4421	Museum of Aviation, Robins AFB, Georgia	On display
BuN141309	4433	Aerospace Museum of California, Sacramento, California	On display
BuN141311	4435	Chanute Air Museum, Rantoul, Illinois	On display
Bun 143221	4495	National Museum of Naval Aviation, Pensacola, Florida	On display
F-BRAD	4519	Nantes, France	On display
CF-TGE	4544	Museum of Flight "Air Park" Boeing Field King County Int Airport, Seattle, Washington State	On display
N005C	4557	Air Mobility Command Museum, Dover AFB, Delaware	On display
D-ALIN	4604	Hermeskeil Museum, Mosel, Germany	On display
IN315	4614	Indian Naval Aviation Museum, Hansa Naval Station, Goa, India	On display
F-BHBG	4626	Quimper, France	Derelict
5T-TAK	4640	Nose section and nose gear on display, TAP Museum, Lisbon, Portugal	On display
F-BHML	4671	F J Strauss International Airport, Munich Germany as D-ALEM	On display
BG583	4686	Agra AFB, India - stored for Indian Air Force Museum needs restoration	stored
N6931	4813	Cockpit section in private collection in France	-
HI-542CT	4825	Aguadilla-Borinquen Airport, Puerto Rico	deteriorating condition
N6937C	4830	National Airline History Museum, Kansas City, Missouri	On display
CF-NAL	4831	Sao Tome International Airport, Sao Tome	Stored
CF-NAM	4832	Sao Tome International Airport, Sao Tome	Stored
N468C	4846	Fuselage section stored Blue Creek, Belize	Stored

**Source**

The Lockheed Constellation Series,  
Piston Engine Airliner Production List,

Peter J Marson, Air Britain Publication, 1982, 2007  
A B Eastwood and J Roach, TAHS October 2002

## Appendix 9 Glossary and Terminology Explained

## Acronyms

AAS	[US] Aeromedical Airlift Squadron
AMARC	[US] Aerospace Maintenance and Regeneration Center
ANG	[US] Air National Guard
ATS	[US] Air Transport Squadron
ATW	[US] Air Transport Wing
AUP	All Up Weight
USAF	United States Air Force
USAAF	United States Army Airforce
CAA	[Australian] Civil Aviation Authority - <i>predecessor of CASA</i>
CAC	Commonwealth Aircraft Corporation
CASA	[Australian] Civil Aviation Safety Authority
FAA	[US] Federal Aviation Administration
HARS	Historic Aircraft Restoration Society
LAME	[Australian] Licenced Aircraft Maintenance Engineer
MAC	[US] Military Airlift Command
MAG	[US] Military Airlift Group
MAS	[US] Military Air Squadron
MSANG	[US] Mississippi Air National Guard
MATS	[US] Military Air Transport Service
MASDC	[US] Military Aircraft Storage and Disposition Center
NASMA	National Air and Space Museum of Australia
TEWG	[US] Tactical Electronic Warfare Squadron

kt	knot
nm	nautical mile
mph	miles per hour
shp	shaft horsepower

## Terms

airworthiness	Airworthiness is the measure of an aircraft's suitability for safe flight. Certification of airworthiness is initially conferred by a certificate of airworthiness from a national aviation authority - in Australia CASA, and subject to the aircraft being maintained by performing the required maintenance actions.
clean	Clean means all wing flaps and undercarriage are retracted so that the wing is in a low drag mode/flying mode. Stall speed is lower when flaps are extended because that is their purpose - to change the wing shape and increase lift for lower speed flight such as takeoff and
Licensed Aircraft Maintenance Engineer	a CASA endorsed person who is qualified to work on particular systems on particular aircraft as noted in that person's licence
Skunk Works	Lockheed Martin design facility "the Skunk Works has existed to create revolutionary aircraft and technologies that push the boundaries of what is possible" <i>Lockheed Martin web site</i>
Turbo compound	Turbo compounding is the process of using a turbine run off exhaust gasses to provide additional power to the crankshaft via gearing and an hydrodynamic coupling
turboprop	A turboprop engine is a turbine engine that drives an aircraft propeller. In contrast to a turbojet, the engine's exhaust gases do not contain enough energy to create significant thrust, since almost all of the engine's power is used to drive the propeller.

**Factors used in this document to convert Imperial Units to Metric Units**

feet	1 foot	=	0.3048 metres
inches	1 inch	=	25.4mm
horsepower [hp]	1 hp	=	0.746 kilowatts [kW]
gallon	1 US gallon	=	3.875 litres
knot	1 knot	=	1.852 km/h
nautical mile	1nm	=	1.852km

## Appendix 10 Biographies of Organisations, Companies and People Associated with VH-EAG "Connie"

### Historic Aircraft Restoration Society Inc. [HARS]

In 1978 an informal group of like minded individuals had come together as a group intent on the acquisition and preservation of the aeronautical memorabilia - including aircraft body sections and engines that they personally owned.

This group went through a succession of 'homes' - Skyville, Schofields, Bankstown

#### How did Bob's group and HARS merge

Around 1979 another group - Historical Aviation Restoration Society came into being basing themselves at Sydney Airport was formed in 1979 by a group of aviation enthusiasts interested in the preservation of Australian aviation history.

The aim of this group was to stem the neglect which had led to the demise of almost any kind of historical aviation flying in Australia and preserve aviation relics of significance to Australia for future generations.

At the time Australia had the fifth largest airforce in the world and had basically lost its capacity to manufacture sophisticated aircraft in Australia.

In the 1980s restoration and operation of historical aircraft in Australia other than small civil vintage types - remained in its infancy. Few *warbirds* were on the civil register, because of the restrictions imposed on flying ex-military aircraft

Around this time CAA, as a result of requests from **????** issued Air Order 109 which gave owners permission to fly ex-military aircraft..

With that hurdle overcome, the members traversed the Australian continent from Tasmania to Kalumburu in North Western Australia and from Cape Llewellyn to Cape York in search of aviation artefacts. These expeditions resulted in providing considerable assistance to many restorations including many outside of the HARS itself.

Of significant importance was the recovery in the early eighties of two Beaufighter airframes from North Western Australia. One, a Mk1 Beaufighter aircraft. A cockpit was exchanged after it had been restored by HARS to sweeten the deal for Lockheed *Super Constellation*. This aircraft now resides in the United States Air Force Museum in Dayton, Ohio. The other airframe is central to the Mk21 Beaufighter currently under restoration by HARS.

On 1 April 1988 they bought their first aircraft a Lockheed P2V-7 [SP-2H] Neptune A89-273 [ex Aeronavale 147566] **HARS or Bob's group?**

A constitution was drawn up and HARS became an incorporated society in 1988.

In 1991 the Australian Taxation Office granted its request for donations to be allowable as a tax deduction. HARS is a Deductible Gift Recipient organisation HARS underwent a restructure in late 1991 with the objective was to have a more business-oriented organisation capable of managing large projects that require significant logistical support.

HARS' Mission Statement strongly expresses its present day emphasis and direction.

*To recover, and where possible restore to flying condition, aircraft or types of aircraft that have played a significant part in Australian Aviation History both in the Civil and Military arenas.*

In order to achieve these objectives HARS attracted specialist people from within the aviation industry who were interested in the preservation of historical aircraft. The result is that it now has within its membership of over 550 people it has over 50 members who are Licensed Aircraft

Maintenance Engineers. Their licensees cover virtually all of the skills recognised within the industry - airframe, engines, electrical/ electronics, instrumentation, radio.

Since 1991, HARS has achieved significant milestones in its endeavours to preserve our aviation heritage. Its record to-date in aircraft restorations alone is there for all to see and is detailed below. It is an impressive record when one considers that it has been achieved solely by volunteers of HARS. It has been financed to-date partly by corporate sponsorship and from the general public.

HARS received a Federal Government Grant of \$275,000 to assist in the erection of the Museum and Education Building. HARS members themselves have also contributed considerable funds and voluntary time towards this project.

There are now 2 hangars totalling **???sqm** of floor space- the main hangar dedicated to static display and the other is used for both storage and as a restoration workshop, at the HARS facility plus **?? sqm** of standing area

### **What are the arrangements with the aerodrome**

HARS has a comprehensive collection of information and drawings which is yet to be formally establish as a library

From an engineering perspective, there is a position of Maintenance Controller and Licensed Aircraft Maintenance Engineers - LAMES, who hold current airframe and engine ratings have been set up in engineering teams responsible for the maintenance outcomes of certain groups of aircraft. These people work strictly in accordance with the CASA approved Maintenance Manual and procedures and quality control requirements.

### **List of Aircraft in HARS Collection**

#### **Airworthy**

CAC CA-25 Winjeel  
Consolidated PBY-6A Catalina  
Cessna 310B  
De Havilland DHA-3 Drover  
De Havilland DHC-4 Caribou  
De Havilland DH-82 Tiger Moth  
Douglas DC3 [aka C-47, Dakota, Skytrain, Gooney Bird]  
Lockheed C-121C *Super Constellation*  
Lockheed P2H [P2V-7] Neptune  
North American NA-16 Texan/Harvard/SNJ

#### **Static Display**

Boeing 747-438  
CAC CA-27 Sabre  
English Electric Canberra  
GAMD [CAC built CA-29] Mirage IIIO  
General Dynamics F-111C  
Hawker Hunter FR-74S  
Piaggio P-166 Portofino

#### **Undergoing Restoration**

Auster J5G Autocar  
De Havilland DH-115 Vampire T-35  
Douglas DC4 [aka C-54, Skymaster]  
Fokker FVIIIB "Southern Cross" Replica  
Grumman S-2G Tracker  
Messerschmitt 108 [NORD 1002]  
LET L-200A Morava

Source: *HARS website*

### Lockheed Corporation

The Lockheed Corporation [originally the Loughhead Aircraft Manufacturing Company] is an American aerospace company focused on the development of military defence aircraft. Lockheed was founded in 1912 and later merged with Martin Marietta to form Lockheed Martin in 1995. Its headquarters are in Burbank California

Throughout its life, in various structure, it has been a major force in the design and production of cutting edge - often being the agent of change in aircraft technology and markets such as the civilian transportation market, civil aircraft - up to 1983 [*Constellations*] and military aircraft [Hudson bomber, Hercules, Lightning, Neptune] and later aerospace craft supplying its aircraft to buyers from all over the globe.

### Lockheed and Lockheed Martin aircraft

<b>Airliners and Civil Transports</b>	<ul style="list-style-type: none"> <li>• Vega</li> <li>• Model 8 Sirius</li> <li>• Altair</li> <li>• Model 9 Orion</li> <li>• Model 10 Electra</li> <li>• Model 12 Electra Junior</li> <li>• Model 14 <i>Super</i> Electra</li> <li>• Model 18 Lodestar</li> <li>• <i>Constellation</i> <ul style="list-style-type: none"> <li>○ L-049</li> <li>○ L-649</li> <li>○ L-749</li> <li>○ L-1049 <i>Super Constellation</i></li> <li>○ L-1249 <i>Super Constellation</i></li> </ul> </li> <li>• L-1649 Starliner</li> <li>• Saturn</li> <li>• L-188 Electra</li> <li>• L-402</li> <li>• JetStar</li> <li>• L-100 Hercules</li> <li>• L-1011 TriStar</li> </ul>
<b>Military Transports</b>	<ul style="list-style-type: none"> <li>• C-69 <i>Constellation</i></li> <li>• C-121 <i>Constellation</i></li> <li>• C-130 Hercules <ul style="list-style-type: none"> <li>○ C-130J <i>Super</i> Hercules</li> <li>○ HC-130</li> <li>○ KC-130</li> <li>○ LC-130</li> <li>○ MC-130</li> </ul> </li> <li>• C-141 Starlifter</li> <li>• C-5 Galaxy</li> <li>• R6V Constitution</li> <li>• Tristar {RAF}</li> </ul>
<b>Attack and Bombers</b>	<ul style="list-style-type: none"> <li>• YP-24</li> <li>• Hudson</li> <li>• XB-30</li> <li>• Ventura</li> <li>• AC-130</li> <li>• A-4AR Fightinghawk</li> <li>• F-117 Nighthawk <ul style="list-style-type: none"> <li>○ <i>Have Blue</i></li> <li>○ FB-22</li> </ul> </li> </ul>

<b>Drones/ UAVs</b>	<ul style="list-style-type: none"> <li>• AQM-60 Kingfisher</li> <li>• D-21</li> <li>• Desert Hawk</li> <li>• Desert Hawk III</li> <li>• MQM-105 Aquila</li> <li>• Polecat</li> <li>• RQ-3 Darkstar</li> <li>• RQ-170 Sentinel</li> <li>• DC-130</li> </ul>
<b>Early Warning and Reconnaissance</b>	<ul style="list-style-type: none"> <li>• YO-3</li> <li>• EC-121 Warning Star</li> <li>• EC-130 <ul style="list-style-type: none"> <li>◦ EC-130H Compass Call</li> </ul> </li> <li>• WC-130</li> <li>• EP-3</li> <li>• U-2</li> <li>• TR-X</li> <li>• A-12</li> <li>• SR-71 Blackbird</li> </ul>
<b>Fighters</b>	<ul style="list-style-type: none"> <li>• XFM-2</li> <li>• YP-24</li> <li>• P-38 Lightning</li> <li>• XP-49</li> <li>• XP-58 Chain Lightning</li> <li>• P-80 Shooting Star</li> <li>• XF-90</li> <li>• F-94 Starfire</li> <li>• F-104 Starfighter <ul style="list-style-type: none"> <li>- variants</li> </ul> </li> <li>• YF-12</li> <li>• F-16 Fighting Falcon</li> <li>• F-22 Raptor <ul style="list-style-type: none"> <li>- YF-22</li> </ul> </li> <li>• F-35 Lightning II</li> <li>• XFY-1 "Pogo"</li> </ul>
<b>Helicopters</b>	<ul style="list-style-type: none"> <li>• CL-475</li> <li>• XH-51</li> <li>• AH-56 Cheyenne</li> <li>• VH-71 Kestrel</li> </ul>
<b>Maritime Patrol</b>	<ul style="list-style-type: none"> <li>• P-2 Neptune</li> <li>• P-3 Orion</li> <li>• P-7</li> <li>• S-3 Viking</li> <li>• CP-140 Aurora</li> </ul>
<b>Trainers</b>	<ul style="list-style-type: none"> <li>• T-33</li> <li>• T2V Sea Star</li> </ul>
<b>Experimental</b>	<ul style="list-style-type: none"> <li>• NF-104A</li> <li>• Senior Peg</li> <li>• Senior Prom</li> <li>• XC-35</li> <li>• XF-104</li> <li>• XV-4 Hummingbird</li> <li>• X-7</li> <li>• X-17</li> <li>• X-26B Frigate</li> <li>• CL-1200 Lancer</li> </ul>

	<ul style="list-style-type: none"> <li>• X-33</li> <li>• X-35</li> <li>• X-44</li> <li>• X-55</li> <li>• X-56</li> <li>• X-FV</li> </ul>
<b>Other</b>	<ul style="list-style-type: none"> <li>• Air Express</li> <li>• Big Dipper</li> <li>• Model 44 Excalibur</li> <li>• Explorer</li> <li>• Little Dipper</li> </ul>

Source: *Lockheed Martin website*

### **Curtiss-Wright**

Curtiss-Wright had its roots in the earliest successes of the Wright Brothers and Glenn Curtiss with the merger of Curtiss Aeroplane and Motor Corporation. The Wright Aeronautical Corporation. came into existence on July 5, 1929 when 12 companies associated with Curtiss Aeroplane and Motor Company of Buffalo, New York, and Wright Aeronautical of Dayton, Ohio merged. . This new organisation was the largest aviation company in the country. Its headquarters were in Buffalo, New York

Curtiss-Wright designed and built aircraft for military, commercial, and private markets. It was the Wright engine division and the longstanding relationship with the US military that would, during World War 2, produce 142,840 aircraft engines, 146,468 electric propellers and 29,269 airplanes.

Aircraft production during World War 2 included almost 14,000 P-40 fighters, over 3,000 C-46 Commando transport aircraft, and later in the war, over 7,000 SB2C Helldivers and the P-40, variously known as the Tomahawk, Kittyhawk, and Warhawk.

Today it is a large profitable and diversified company but no longer produces aircraft or aircraft engines.

Details of the Wright R3350 duplex cyclone radial aircraft engine are given in Appendix 5

### **Qantas**

Qantas is the flag carrier airline of Australia. It is the third oldest airline after KLM and Avianca having been founded in November 1920 as Queensland and Northern Territory Aerial Services flying domestic routes. It began international passenger flights in May 1935 when it commenced a service from Darwin to Singapore.

. In June 1959 it entered the jet-age when its first Boeing 707-138 was delivered. The entire Qantas group serves 65 domestic and 27 international destinations; its flight to Fort Worth USA is the world's longest passenger flight

Qantas and its subsidiaries operate 299 aircraft.

In the aftermath of World War 2, the Qantas aircraft fleet was in a poor state due to the huge demands that had been placed on the airline. It was imperative its depleted fleet was replaced with a suitable aircraft as soon as possible if it was to continue and expand its routes.. As it turned out, Qantas was able to accurately assess the technological and commercial capability of the aircraft on offer and to resist the political pressure being applied by Britain and bought US Lockheed L-767 as the aircraft best suited to its needs.

Qantas - then Qantas Empire Airways owned by the Australian government, bought six L749 - later upgraded to L749A standard for the Kangaroo Route. First Flight 1 December 1947 With sixteen L1049 *Super Constellations*, from April 1954 Qantas expanded its worldwide services further, including for the first time, across the Pacific to the United States. In January



1958, the Australian flag carrier inaugurated the world's first regular passenger around-the - world service that traversed both hemispheres.

Comment: Pan Am began a regular service in 1947 that flew from San Francisco to New York but because it did not fly across continental USA it could not be said to be an around-the-world service.

Qantas operated the L1049C and then the 1049E variants. The airline purchased two convertible passenger/ freight L1049H aircraft, but none were more beautiful than the long-nose L1049Gs with wing-tip tanks. Qantas purchased two of these, and converted several of its E models to G models.

The long nose accommodated a weather radar unit, not fitted to earlier *Constellation* and *Super Constellation* models.

Qantas and the other major airlines of the world began to retire their *Super Constellations* and other piston types from 1959 in many cases trading them in for the first jets for their fleet. [The first Qantas Boeing 707 arrived in 1959.]

*Source Ref 1 and Qantas website*

### **Pima Air & Space Museum**

The concept of Pima Air and Space Museum [PASM] began in 1996 during the celebration of the USAF. Earlier commanders of Davis-Monthan AFB and MASDC the forerunner of AMARG recognised that the historic WW 2 and 1950s era aircraft stored on the base were being lost to the smelters. So to preserve the aviation heritage of the country they began to set aside examples of the many types of aircraft stored in MASDC's yards. The collection was to be a museum that was accessible by the general public and in 1973 moved to a new site just south of the Davis-Monthan AFB. As could be expected the collection grew over the years as did the facilities that housed and maintained them so today in its there are four major hangars and a Space Gallery and is now one of the largest non-military aviation museums in the country with a collection of more than 300 aircraft.

### Appendix 11 Author's Category of Award Assessment of Engineering Heritage Significance for Super Constellation VH-EAG "Connie"

Historical Significance	Indicate 'Agree' or leave blank	
	International, National or State heritage significant	Other than International, National or State heritage significant
<b>Guidelines for inclusion</b>		
Shows evidence of a significant human activity.	<b>Agree</b>	
Is associated with a significant activity or historical phase.	<b>Agree</b>	
Maintains or shows the continuity of a historical process or activity.	<b>Agree</b>	
<b>Guidelines for exclusion</b>		
Has incidental or unsubstantiated connections with historically important activities or processes.		
Provides evidence of activities or processes that are of dubious importance.		
Has been so altered that it can no longer provide evidence of a particular association		
<b>Historic Individuals or Association</b>		
<b>Guidelines for inclusion</b>		
Shows evidence of a significant human occupation.	<b>Agree</b>	
Is associated with a significant event, person, or group of persons.	<b>Agree</b>	
<b>Guidelines for exclusion</b>		
Has incidental or unsubstantiated connections with historically important people or events.		
Provides evidence of people or events that are of dubious historical importance		
Has been so altered that it can no longer provide evidence of particular association.		
<b>Creative or Technical Achievement</b>		
<b>Guidelines for inclusion</b>		
Shows or is associated with, creative or technical innovation or achievement.	<b>Agree</b>	
Is aesthetically distinctive.	<b>Agree</b>	
Has landmark qualities.	<b>Agree</b>	
Exemplifies a particular taste, style, or technology.	<b>Agree</b>	
<b>Guidelines for exclusion</b>		
Is not a major work by an important designer or artist.		
Has lost its design or technical integrity.		
Its visual or sensory appeal or landmark qualities have been more than temporarily downgraded.		
Has only a loose association with a creative or technical achievement.		

Research Potential	Indicate 'Agree' or leave blank	
	International, National or State heritage significant	Other than International, National or State heritage significant
<b>Guidelines for inclusion</b>		
Has the potential to yield new or further substantial scientific and/or archaeological information.		
Is an important benchmark or reference site or type.	<b>Agree</b>	
Provides evidence of past human cultures that is unavailable.		
<b>Guidelines for exclusion</b>		
Has little archaeological or research potential.		
Only contains information that is readily available from other resources or archaeological sites.		
The knowledge gained would be irrelevant to research, human history, or culture.		
<b>Social</b>		
<b>Guidelines for inclusion</b>		
Is important for its association with an identifiable group.	<b>Agree</b>	
Is important to a community's sense of place.	<b>Agree</b>	
<b>Guidelines for exclusion</b>		
Is only important to the community for amenity reasons.		
<b>Rarity</b>		
<b>Guidelines for inclusion</b>		
Provides evidence of a defunct custom, way of life or process.	<b>Agree</b>	
Demonstrates a process, custom, or other human activity that is in danger of being lost.	<b>Agree</b>	
Shows unusually accurate evidence of a significant human activity.	<b>Agree</b>	
Is the only example of its type.	<b>Agree</b>	<i>One of two</i>
Demonstrates designs or techniques of exceptional interest.	<b>Agree</b>	
Shows rare evidence of a significant human activity important.	<b>Agree</b>	
<b>Guidelines for exclusion</b>		
Is not rare.		
Is numerous but under threat.		